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PRIMARY GLAUCOMA

A SYMPTOM COMPLEX OF EPIDEMIC DROPSY

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Epidemic dropsy is a disease which is common in Bengal and which presents the following features:

1. It always affects rice eaters. The incidences is high when rice is the staple article of diet, low when a little rice is eaten and nil when no rice is consumed. In nearly all cases the disease is caused by rice that has been parboiled, highly polished and stored in hot and damp places for months after milling.

2. In many outbreaks of the disease it has been possible to trace the source of infection to the same rice store, although the people affected have been widely separated. In early cases, if rice is eliminated from the diet the disease ceases to progress, but in advanced cases in which considerable damage has been done to the tissues the disease often fails to respond quickly and frequently progresses for a considerable time. Outbreaks of epidemic dropsy usually occur during the rainy season and the months immediately following the rains, although they have been known to occur during any season.

3. When the new rice crop is used, the disease quickly disappears. Both sexes are equally affected. Children do not escape the disease, although infants are not affected. The disease occurs most often in people of the middle class who lead a sedentary existence, such as clerks and students, and is uncommon among the laboring class. Servants of the household are often affected, since they eat the same parboiled rice as their masters. The disease occurs principally among Hindus whose staple article of diet is rice, but it is common among Mohammedans, who are also rice eaters. Cases occur among Anglo-Indians and Europeans, but they are uncommon and are usually in the very poor whose principal article of diet is rice.

4. The etiology of the disease is not definitely known, but it is generally agreed that epidemic dropsy is a different disease from beriberi. Both diseases belong to a toxic group in which the three principal signs are edema, hypertrophy with dilatation of the heart and peripheral neuritis. In epidemic dropsy edema and cardiac signs are usually present, but peripheral neuritis is absent as a rule, while in the dry

variety of beriberi there are peripheral neuritis and cardiac lesions, but edema is never a marked sign. Beriberi is caused by a deficiency of vitamin B in the diet and can be produced by rice, but it occurs in epidemic form and is associated with conditions of famine, while epidemic dropsy is caused by a toxin produced in diseased rice, partly manufactured in the rice itself before ingestion and partly in the alimentary canal of the affected person. The latter origin explains the continuation of symptoms in persons who have ceased to eat infected rice.

Acton, Chopra and their co-workers [1] in the Tropical School of Medicine, at Calcutta, isolated a spore-forming proteolytic bacillus of the vulgatus group which is commonly found in diseased rice; this bacillus has been found in the urine and stools of a number of patients. It produces a toxin which is soluble in water, resembles histamine and causes a "cardiocapillary crisis." The toxin develops in rice stored in damp, dark places during the hot and rainy seasons and resists destruction by cooking. The infected rice grains are usually found to be spotted or wholly opaque and may float on water. Under the low power microscope, yellowish, oval bodies are sometimes seen.

According to Chopra, the toxins are absorbed through the liver, which shows the typical lesions, and thus get into the general circulation. Symptoms may start as early as twenty-four hours after the ingestion of infected rice and may continue for many weeks after the patient has ceased to eat infected grain. The toxins may be stored in the cells of the liver and other glands of secretion, and the digestive juices and bile may be the path by which the toxin is poured into the intestine, causing the gastro-intestinal symptoms to persist. Elimination takes place by the feces and urine, and a relapse is known to occur after an initial improvement, which can be explained only on the grounds that a dose of this stored-up toxin is released into the general circulation. The disease is not infectious and is not spread by patients who go to nonendemic areas for a change of climate. The rare cases in which people have been affected after contact with persons suffering from the disease have invariably occurred in endemic localities or following the ingestion of rice imported from these areas.

5. One attack does not confer immunity, but rather predisposes persons to a relapse in subsequent epidemics if they eat infected rice, and they are the first to contract the disease. They appear to become permanently sensitized to the toxin and should therefore give up eating rice.

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1. Acton, H. W., and Chopra, R. N.: The Problem of Epidemic Dropsy and Beri Beri, Indian M. Gaz. **60**:1, 1925; Further Investigations into the Etiology of Epidemic Dropsy, ibid. **62**:359, 1927. Chopra, R. N., and Bose, S. C.: Cardio-Vascular and Other Manifestations of Epidemic Dropsy, ibid. **68**:605, 1933.

6. The best prophylactic against epidemic dropsy is to expose the rice to the sun properly at regular intervals during the hot and rainy seasons and not to keep it perpetually in dark, damp places.

CLINICAL FEATURES

In most cases there is an initial toxic diarrhea, which may be mild or severe, associated with nausea or vomiting. Acton and Chopra found typical gram-positive bacilli in the stools of these patients early in the disease, while the majority of the organisms in the stools of the controls were gram-negative bacilli with the ordinary gram-positive cocci. In severe cases diarrhea sometimes persists for a long time, but in mild cases it may be absent, or constipation may be present. Gastro-intestinal symptoms vary inversely as cardiac symptoms; diarrhea brings relief in severe cases, while constipation is often accompanied by cardiac symptoms.

The occurrence of an unexplained dropsy in several members of the same family takes place only in epidemic dropsy or beriberi. Edema usually appears after the gastro-intestinal symptoms, yet many cases occur in which edema is the first sign to be noticed. It is more marked in the lower extremities, but may affect the whole body, even the head. Edema is the most constant sign of epidemic dropsy, and it may be the only sign. The initial edema of epidemic dropsy is of the solid type and consists of two stages, dilatation of the capillaries and the production of a small amount of lymph. The skin of the affected part is often dark red and is hot and tender. The discoloration of the skin resembles erythema but is darker, though it never reaches the degree of cyanosis. In some cases dilatation of the capillaries in the skin may lead to bleeding ulcers. As the disease progresses, and the symptoms become worse, the edema increases in extent and the skin pits on pressure.

The cardiac symptoms are characterized by shortness of breath and palpitation on exertion, and cardiac failure is of the acute congestive type. There is enlargement of the heart, with congestion of the veins, but the valves are not diseased. Tachycardia is constant, varying from 110 to 140 beats per minute, and there is usually a fall of both the systolic and the diastolic blood pressure. The capillaries are greatly dilated, so that the affected tissue looks angiomatous from a distance. Rupture of blood vessels is very uncommon.

Lesions of the peripheral nerves are extremely variable and are not reliable in diagnosis. The knee jerks may be absent, exaggerated or normal, so that there is undoubted evidence of neuritis in some cases. The sensory nerves are not involved as a rule. Bronchitis with profuse sanguineous expectoration, epistaxis and signs of edema are sometimes present.

The blood picture shows a marked diminution of the red cells; the percentage of hemoglobin is diminished, and the anemia is of the secondary type and is a prominent feature in all cases. In the early stages of the disease the anemia may be due to widespread capillary dilatation, causing capillary stasis, and later it may be produced by the action of the toxins absorbed from the alimentary canal. In most cases there is a slight leukocystosis. The total nitrogen value is much below normal, this being due mainly to the diminished number of red cells, as the nitrogen value of the serum has been found to be about normal. The nonprotein nitrogen content is normal, which is what one would expect to find, as in epidemic dropsy the renal function is normal. The urea and the creatinine content of the blood do not show any deviation from the normal, although the uric acid content is increased. In most cases examination of the blood shows that there is retention of chlorides, which may be one of the causes of the edema. The edema is not cardiac in origin, as in many cases in which edema was marked cardiac symptoms were slight or absent altogether, and many patients without appreciable anemia have died of cardiac failure. In epidemic dropsy there is hydremia of the blood, the mottled erythema of the skin and the areas of capillary dilatation, often accompanied by pemphigoid eruptions, show that the edema is not passive but that there is some active change going on in the capillaries, so much so that they have multiplied, leading to the formation of angiomatous masses. The calcium content of the blood is below normal. In normal serum, the quantity of albumin exceeds that of globulin, the relation being 1.5 : 1, but in epidemic dropsy the serum albumin is considerably decreased and the globulin content is nearly three times that of the albumin content.

As a rule, the signs and symptoms of epidemic dropsy appear a short time after infection, the period varying according to the severity of the epidemic. It is possible that there may be some variation in the micro-organisms that cause the toxins, as there is a certain amount of difference in the clinical signs of the disease. For example, in some epidemics the skin was harsh and dry, while in others it showed diffuse erythema. In some epidemics there were marked cardiovascular signs and symptoms, while in others the heart and the pulse rate were normal. Again, in some epidemics nervous manifestations such as exaggerated reflexes and paralysis of muscles were present, while in others the nervous system was not involved.

In epidemic dropsy, the pathologic feature of particular interest is the telangiectatic dilatation of the capillaries, which is most marked in the fatty tissue underneath the pericardium and the peritoneum. This dilatation is also found in the alveolar capillaries of the lungs, in the uterus, in the ovaries and in the intestines. It has been observed to occur where the vessels are least supported. There is no inflammatory

reaction or wandering cells around the dilated blood vessels, and, as a rule, there is little tendency to hemorrhage, although hemorrhages do occur. Occasionally dilated blood vessels in the skin project forward, forming hemangiomas, and at times these rupture and bleed profusely. Dilated blood vessels were also found in the ciliary body, iris and choroid in cases in which there were no clinical ocular signs or symptoms before death. I have never studied the morbid anatomy of the eye in cases of epidemic dropsy associated with glaucoma, as in the large number of cases in which I have operated I have been fortunate enough never to lose an eye.

Glaucoma associated with epidemic dropsy was first described by Maynard [2] in a report of 100 cases which occurred in the outbreak of epidemic dropsy from 1908 to 1909.

Observations on 253 cases in Bengal were reported by Mukerji [3] in 1927.

During the last quarter of 1929 and the first quarter of 1930, a large outbreak of epidemic dropsy occurred in Bengal and Calcutta, and during the last quarter of 1932 and the first quarter of 1933, there was a less severe outbreak in the same areas. During these outbreaks a large number of cases of glaucoma occurred; 325 of the patients came under my care, the affected persons being from Calcutta and from various endemic areas in Bengal.

The glaucoma associated with epidemic dropsy is of the primary noninflammatory type, and the eye remains quite white even in cases in which the tension is extremely high.

Increased intra-ocular tension usually occurs as a late manifestation of the disease, but in the epidemic of 1932 to 1933 a large number of persons with glaucoma were seen with slight or no other general signs of the disease. Some of those in the latter category gave a history of having contracted the disease in a previous epidemic but, on the other hand, a number gave an irrelevant history, so that in some cases the toxin showed a special predilection for the intra-ocular capillary endothelium, while in the majority of cases this endothelium was involved with the general endothelial system of the body.

The incidence of glaucoma as regards the type of person, age and sex is the same as in the general disease. It is more often seen in persons between the ages of 20 and 35, but I have frequently seen cases of glaucoma associated with epidemic dropsy and a high intra-ocular tension in Indian boys and girls from 8 to 15 years of age.

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2. Maynard, F. P.: Note on Increased Intra-Ocular Tension in Cases of Epidemic Dropsy, Indian M. Gaz. **44**:373, 1909.

3. Mukerji, S. K.: Glaucoma as a Result of Epidemic Dropsy, Proc. of the Seventh Far Eastern Cong., 1927, p. 272.

The first symptoms of glaucoma to be noticed are rainbow colors, halos around lights and gradual diminution of vision. These halos are at first transient, but as the disease becomes more marked, they become permanent. Both eyes are usually affected at the same time, although some patients give a history of one eye being affected first. Patients complain also of difficulty in reading, as their sight is blurred. The disease is not accompanied by pain, as a rule, but occasionally there is a sensation of discomfort or heaviness in the eyes. Nausea and vomiting are absent. In almost all cases the conjunctiva and sclera are not affected except for the turgescence of the anterior ciliary veins, which stand out prominently. In the few cases in which congestion of the conjunctiva was observed it was explained by the previous instillation of physostigmine. The corneas may be normal in appearance, or they may have a steamy or ground-glass appearance, depending, as a rule, on the amount of increased tension in the eyes, but in all cases examination with the corneal microscope shows evidence of corneal edema. The rainbow rings which are due to edema of the cornea are always a marked symptom of the disease, and they are an important point in distinguishing the glaucoma of epidemic dropsy from ordinary primary glaucoma, as in the latter variety the rainbow halos are not always present. The anterior chamber is never shallow as in other types of glaucoma; it is either normal or deeper than normal, and there is never any pushing forward of the lens and iris. The glaucoma is therefore of the anterior segment type in contradistinction to the posterior segment type in which the anterior chamber is shallow. Swelling of the vitreous body, which usually plays a predominant part in the pathogenesis of glaucoma, is absent, and therefore swelling of this body is not necessarily an essential factor in the causation of glaucoma. The increased intra-ocular pressure is due to the dilatation of the capillaries of the uveal tract followed by an increased permeability of the endothelial walls which leads to an increased output of intra-ocular fluid in the anterior segment of the eye. The pupil is normal in appearance and reacts well to light and in accommodation. Examination with the corneal microscope shows no evidence of inflammation in the aqueous or the iris. In the cases studied, dilatation of the vessels in the iris probably was present, but the vessels could not be seen owing to the heavy pigmentation of the iris in natives of Bengal. The ciliary body like the iris was not involved, except that weakness of accommodation was nearly always present. The media and lenses were normal. Even in advanced or absolute glaucoma of this type opacities of the lens have never been observed. The fundus cannot always be seen clearly owing to the corneal edema, but in most cases glaucomatous cupping is not present. In long-standing cases of two or three months' duration, cupping is present with evidence of atrophy of the disk, and the cupping

becomes more marked according to the duration of the disease. The fundi were carefully examined in a large number of cases before operation and also after operation when the intra-ocular tension had decreased to normal, and there were no gross changes. The veins either were normal in size or showed some engorgement, and they appeared much darker than normal. Chopra noticed in many of his cases that on venesection the blood was dark chocolate-colored instead of dark red and that the serum was bile-tinted. His observations can be verified by ophthalmoscopic examination. Retinal exudations do not occur.

The outstanding phenomenon of this variety of glaucoma is the extremely high tension. It is rarely below 50 mm. of mercury (Schiötz), and tensions of from 70 to 100 mm. of mercury are quite common. I have seen some cases in which the intra-ocular tension was over 100 mm. of mercury. The tension, as a rule, remains high constantly, but cases occur in which it varies tremendously, even dropping to normal for a short time. Both eyes are affected, although I have seen a case in which one eye was affected at first and the other was involved a month later. The tension is usually about the same in both eyes. With such high tension, one wonders why blindness from optic atrophy does not result much more quickly. The optic nerves seem to resist the high tension for a number of weeks before any evidence of atrophy is found in the visual fields, but unless the tension is relieved optic atrophy of some degree invariably results, at times progressing to complete blindness. Cases are seen in which the glaucoma disappears spontaneously after the general disease has disappeared, leaving the defects in the visual fields dependent on the duration of the increased intra-ocular tension.

The defects in the visual fields in the glaucoma of epidemic dropsy are much the same as in chronic primary glaucoma. In early cases there is depression of the peripheral field starting in the nasal quadrants. The upper, lower or both quadrants may be affected. In later stages the visual fields show concentric depression. Most cases show Roenne's step. The color fields react in the same way as the fields for white and shrink as the fields become contracted. In more advanced cases there is a general depression of the peripheral fields; the upper and lower quadrants are more affected than the outer quadrant, and the blind area gradually increases till the field is reduced to an oval or irregular area, leaving the fovea and the blindspot intact. This field may be horizontal on the temporal side, but it may be in one or the other quadrant. In more advanced cases the central vision disappears, leaving only a small eccentric field, and finally this small area also disappears. As in primary glaucoma, various atypical fields are found in the early stages. One quadrant in the nasal field may be affected out of all proportion to the other; the visual fields of the two eyes may be

markedly different, and the blind area may be more advanced in one eye than the other, but the nasal fields are always more affected than the temporal fields. Examination of the central field shows a pericecal depression, and the scotoma, relative or absolute, is continuous with the blindspot to a varying extent. In later stages Seidel's and Bjerrum's signs can be demonstrated according to the duration of the disease. Cases have been seen in which the visual fields improved after operation, Bjerrum's scotoma changing again into Seidel's scotoma; the latter may diminish in size or may disappear completely, leaving the blindspot normal.

Some observers state that glaucoma does not occur in cases in which there is profuse diarrhea, but this is not my experience, and I have seen many cases with high intra-ocular tension accompanied by diarrhea. Purgation produced by the administration of saline solution has no effect in lowering intra-ocular tension in this type of glaucoma.

In the treatment of the general disease the important thing is to eliminate rice completely from the diet and to wash out the alimentary canal by the administration of purgatives and large amounts of fluid. Convalescence is slow, and recovery may take a considerable time, depending on the severity of the attack. In mild cases, the most practical therapeutic measure is to get the patient away from the endemic area, as it is difficult for the average Indian patient to refrain from eating rice, his staple article of diet, for any considerable time. The dietetic and medicinal treatment for this type of glaucoma are most unsatisfactory. Some patients get well without therapy, but invariably a damaged visual field results, depending on the severity and duration of the disease. Purgatives, diuretics and diaphoretics are of little use, even to reduce the tension to a lower level. Intravenous injections of hypertonic saline solutions have been tried without any effect. Miotics, such as pilocarpine and physostigmine, are practically useless, and these have been used so extensively that the pupil becomes pinhole in size. This therapeutic sign is useful in the differential diagnosis from ordinary chronic primary glaucoma, in which the tension usually reacts more or less to miotics. Epinephrine packs placed under the upper lids have also proved useless. I never prescribe physostigmine in cases of epidemic dropsy associated with glaucoma, as it has the added disadvantage of causing hyperemia of the conjunctiva, thus making operative treatment more difficult.

As long as the visual fields show no defect, there is no necessity of carrying out an immediate operation in the hope that the general disease, and with it the glaucoma, will be cured before the optic nerves become permanently damaged by the increased intra-ocular tension. The patient should be kept under observation and should refrain from eating rice, but as soon as defects in the visual fields become evident operation should

not be delayed. One would think that this type of glaucoma is, of all known varieties, a primary glaucoma, and that a temporizing operation could be done, as the patient will get well spontaneously when the cause is removed and all that is necessary is to keep the tension down until this end is achieved by repeated anterior sclerotomies. In practice this is not sufficient, as it takes a considerable time to get the disease under control in spite of the withdrawal of rice from the diet and the use of eliminative treatment. I have carried out repeated anterior sclerotomies in a large number of cases, but they only lower the tension for a number of hours. Since I have found the tension to be as high or even higher twelve hours after operation, this type of treatment has been abandoned. A complete iridectomy was also tried in a number of cases and was found to be of little use in keeping the tension down. By far the most successful method is the Elliot operation with a 1.5 mm. trephine. During this operation, as may be expected, the iris balloons into the trephine hole and the aqueous escapes under great pressure. A small peripheral iridectomy is done. I have never seen intra-ocular hemorrhage at the time of the operation, even when operating on eyes with extremely high tension. The results of trephining are excellent, and the tension seldom rises again once the decompression is carried out. I have found in a small number of cases a moderate increase of tension several days after operation, but this can always be controlled by gentle ocular massage. In the course of time, when the general disease is cured, the trephine hole closes. I have had to perform a second trephination on some patients in whom glaucoma developed again in a subsequent attack of epidemic dropsy. It is of interest to note that in this type of glaucoma the optic atrophy is caused by the increased intra-ocular pressure alone and cannot be attributed to the toxins that cause epidemic dropsy. Once the increased intra-ocular tension is relieved by operation and the tension of the eye remains normal, optic atrophy ceases to progress. In a number of patients I have observed the fields carefully for a considerable time after operation, and in a few patients up to a maximum period of six years, and invariably the field has remained the same or has slightly improved after operative treatment. Another point of great practical interest is that I have never seen a case of this type of glaucoma in which opacities of the lens have developed after operation which could be attributed to sclerocorneal trephining; neither have I seen a case of late infection after operation.

The following cases are illustrative of typical epidemic dropsy associated with glaucoma. The charts are also presented, and for simplicity each is a combination of the maps obtained with the perimeter and the Bjerrum screen. The former instrument was used for ascertaining the limits of the peripheral field of vision at a distance of one-third meter, while the latter was used for examining the central and paracentral

parts at a distance of 1 meter. To obtain a correct scale relation on the combined chart, the map of the central and paracentral parts of the field of vision has been reduced threefold. The form stimuli used were white on black, and their sizes are recorded on the charts.

REPORT OF CASES

CASE 1.—S. K. D., a Hindu, aged 41, admitted to the hospital on Sept. 1, 1932, complained that he had palpitation of the heart and foggy vision and saw colored halos around lights with both eyes. The cardiac symptoms were of two months', and the ocular symptoms of about two weeks' duration. On examination, the heart beats were rapid, and there was slight edema of the lower extremities. In the right eye vision was 6/9 and in the left eye, 6/9. The tension of the right eye was 50 mm. of mercury and that of the left eye, 45 mm. Both anterior chambers were normal, and the pupils were small and reacted well to light and in accommodation. Ophthalmoscopic examination showed no glaucomatous cupping. Exami-

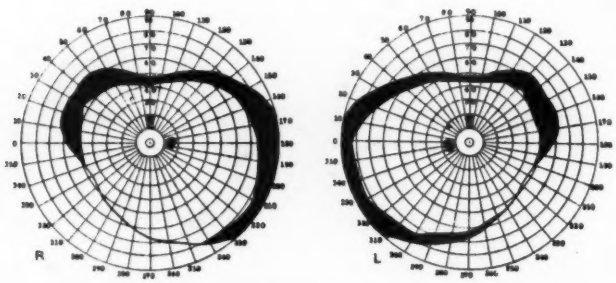

Chart 1 (case 1).—The visual fields on Sept. 1, 1932, before operation. The vision in both eyes was 6/9. The tension of the right eye was 50 mm. of mercury (Schiötz), and that of the left eye was 45 mm. In this and the following charts the form stimuli used were white on black. The sizes of the form stimuli in case 1 were 3/333 and 3/1,000.

nation of the visual fields revealed a slight depression of the peripheral fields and an early enlargement of the blindspot in both eyes. Both eyes were trephined, and the patient was discharged from the hospital on September 24. The tension of the right eye was 25 mm. of mercury and that of the left eye, 18 mm. The vision in both eyes was 6/6.

CASE 2.—D. P. R., a Hindu, aged 20, admitted to the hospital on Sept. 27, 1932, complained that he had palpitation of the heart, swelling of both feet and defective vision and saw colored halos around lights with both eyes. The general symptoms were of six weeks' duration; the halos were transient at first, but a week before admission they became permanent. There was no diarrhea. The patient had had a previous attack of epidemic dropsy in 1931. The vision in both eyes, corrected with glasses, was normal. The tension of the right eye was 50 mm. of mercury and that of the left eye, 60 mm. Both eyes showed slight general depression of the peripheral fields; there were no scotomas, and the blindspots were normal. Miotics and other medicinal treatment were of no use in lowering the tension, which hardly varied prior to operation. Anterior sclerotomy was carried out twice on

both eyes, but within twelve hours the tension was high again. Both eyes were trephined, and the patient was discharged from the hospital on October 20. The tension of the right eye was 18 mm. of mercury and that of the left eye, 20 mm. The vision, corrected with glasses, was 6/6. Ophthalmoscopic examination showed no glaucomatous cupping, and the color of the disks was normal.

CASE 3.—G. B. B., a Hindu, aged 25, was admitted to the hospital on Jan. 6, 1933, with the complaint of dimness of vision, difficulty in reading and of colored halos around lights. The halos were of two months' duration; they were transient at first, but for three weeks prior to admission had been more or less

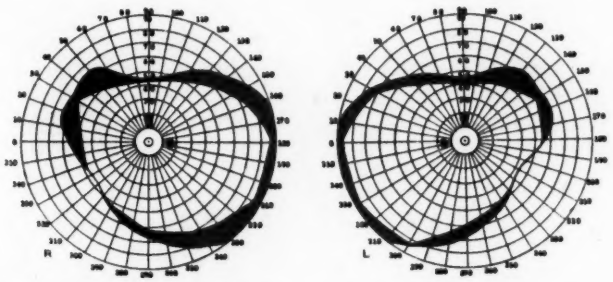

Chart 2 (case 2).—The visual fields on Sept. 26, 1932, before operation. The vision in both eyes was 6/24; corrected with —1.25 diopter sphere, it was 6/6. The tension of the right eye was 50 mm. of mercury (Schiötz), and that of the left eye was 88 mm. The sizes of the form stimuli were 3/333 and 3/1,000.

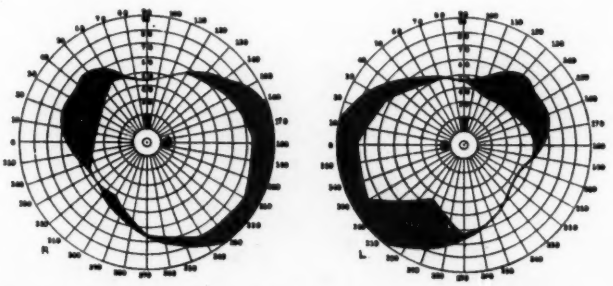

Chart 3 (case 3).—The visual fields on Jan. 5, 1933, before operation. The vision was 6/9 in both eyes. The tension of the right eye was 100 mm. of mercury (Schiötz), and that of the left eye was 88 mm. The sizes of the form stimuli were 3/333 and 3/1,000.

constant. They were first noticed with the left eye. Diarrhea was present. There was slight edema of both feet, but there were no cardiac signs. Five other members of the family were affected with epidemic dropsy. The vision in both eyes was 6/9. The tension of the right eye was 100 mm. of mercury (Schiötz) and that of the left eye, 88 mm. In spite of the high tension, there was no ocular pain and the eyeballs looked normal. The anterior chambers were deep, and the pupils reacted well to light and in accommodation. Ophthalmoscopic examination showed no lesion in the right fundus and shallow glaucomatous cupping in the left fundus. The disk was of a good color. Examination of the visual fields revealed a general

depression of the peripheral fields which was more marked in the left eye. The blindspots were practically normal.

Local and general medicinal treatment proved of no use in lowering the tension. Both eyes were trephined, and the patient was discharged from the hospital on Jan. 29. The tension of the right eye was 20 mm. of mercury and that of the left eye, 18 mm. The vision in both eyes was 6/6.

CASE 4.—S. K. M., a Hindu, aged 19, was admitted to the hospital on Nov. 8, 1932, with the complaint of blurred vision, difficulty in reading and rainbow halos around lights. There was slight edema of both feet, but no cardiac or gastro-intestinal symptoms were present. The patient had had the condition for about two months; the right eye was first affected, and recently the left eye had become involved. Up to the time of his admission he had not been treated for the disease. A number of his relatives were also suffering from epidemic dropsy. There was no history of a previous attack.

In the right eye vision was 6/12 and in the left eye, 6/9. The tension of the right eye was 55 mm. of mercury (Schiötz) and that of the left eye, 50 mm.

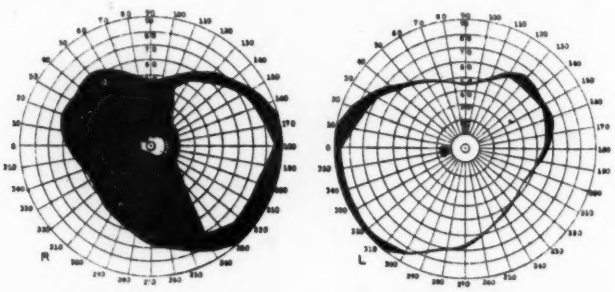

Chart 4 (case 4).—The visual fields on Nov. 8, 1932, before operation. The vision in the right eye was 6/12 and in the left eye, 6/9. The tension of the right eye was 55 mm. of mercury (Schiötz), and that of the left eye was 50 mm. The sizes of the form stimuli were 3/333 and 3/1,000.

Examination of the visual fields showed advanced glaucoma in the right eye. The temporal part of the field showed a general peripheral depression; the nasal field had almost completely disappeared, and there was an annular scotoma extending from the blindspot. The left field was almost normal. Examination of the fundus showed well marked glaucomatous cupping in the right eye, but the left disk was normal.

The right eye was trephined at once. Local medicinal treatment failed to lower the tension in the left eye. Anterior sclerotomy was carried out, but the tension was as high again in twelve hours. Trephining was then done. The patient was discharged from the hospital on November 30. The tension of the right eye was 20 mm. of mercury and that of the left eye, 17 mm. In the right eye vision was 6/12 and in the left eye, 6/6.

CASE 5.—M. A., a Mohammedan, aged 25, was admitted to the hospital on Aug. 5, 1932, with the complaint of defective vision and of seeing rainbow colors for one month with both eyes. There was a history of slight swelling of the legs a few weeks previously, but at the time of admission there was no other evidence of epidemic dropsy except the increased intra-ocular tension in both eyes which

was 66 mm. of mercury (Schiötz) in the right eye and 70 mm. in the left eye. There was marked edema of both corneas, and the vision in both eyes was 6/18 and could not be improved. The anterior chambers were normal in depth; the pupils reacted well to miotics, but the tension remained the same. Ophthalmoscopic examination showed a very shallow cupping of the optic disks, but the color was normal. Examination of the visual fields showed a general depression of the peripheral fields in both eyes, especially of both nasal quadrants. There was a well marked scotoma extending upward from the blindspot in both eyes.

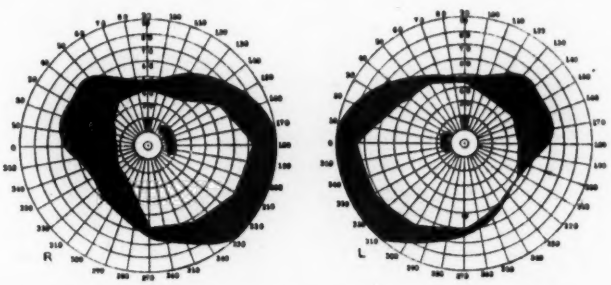

Chart 5 (case 5).—The visual fields on Aug. 2, 1932, before operation. The vision in both eyes was 6/18. The tension of the right eye was 66 mm. of mercury (Schiötz), and that of the left eye was 70 mm. The sizes of the form stimuli were 6/333 and 6/1,000.

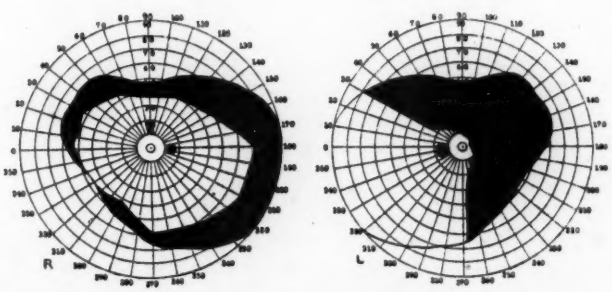

Chart 6 (case 6).—The visual fields on Oct. 28, 1932, before operation. Vision in the right eye was 6/12 and in the left eye, 6/18. The tension of the right eye was 60 mm. of mercury (Schiötz), and that of the left eye was 75 mm. The sizes of the form stimuli were 6/333 and 6/1,000.

Both eyes were trephined, and the patient was discharged from the hospital on August 26. The tension of the right eye was 22 mm. of mercury and that of the left eye, 18 mm. The vision in both eyes was 6/6.

CASE 6.—M. N. C., a Hindu, aged 41, was admitted to the hospital on Oct. 29, 1932, with the complaint of dim vision and of seeing rainbow halos with the left eye for about two months and with both eyes for three weeks. Prior to this there was a history of palpitation of the heart and swelling of the feet, during which time the patient was confined to bed. On admission to the hospital, there were no other signs of epidemic dropsy except the high tension in both eyes, which was 60 mm. of mercury (Schiötz) in the right eye and 75 mm. in the left eye. There

was marked corneal edema, and vision was 6/12 in the right eye and 6/18 in the left eye.

The anterior chambers were normal in depth. Ophthalmoscopic examination of the right eye showed a normal fundus, while that of the left eye showed shallow glaucomatous cupping with distinct pallor at the temporal side of the disk. Examination of the visual fields revealed a general depression of the peripheral field with a normal blindspot in the right eye, and in the left eye both nasal quadrants were blind, the blind area extending into the upper temporal quadrant. The blindspot in the left eye was slightly enlarged.

Both eyes were trephined, and the patient was discharged from the hospital on Nov. 9. The tension of the right eye was 15 mm. of mercury and that of the left eye, 17 mm. In the right eye vision was 6/9 and in the left eye, 6/12.

When the patient was seen again on November 25, both trephine holes were filtering well; the vision in both eyes was 6/6, and the tension of both eyes was 20 mm. of mercury. The visual fields had remained the same except that the blindspot in the left eye had become normal in size.

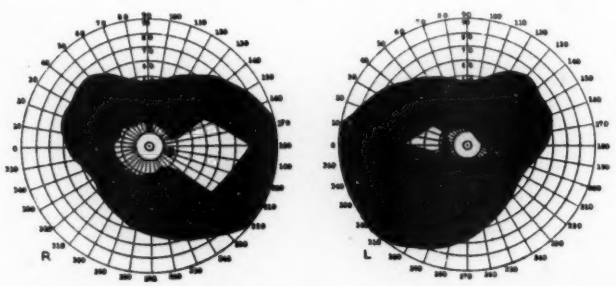

Chart 7 (case 7).—The visual fields on Oct. 26, 1932, before operation. The vision in both eyes was 6/24. The tension of the right eye was 55 mm. of mercury (Schiötz), and that of the left eye was 50 mm. The sizes of the form stimuli were 6/333 and 6/1,000.

CASE 7.—A. M., an Anglo-Indian woman, aged 30, was admitted to the hospital on Oct. 25, 1932, with the complaint of seeing halos and colored rings around lights for three months. Recently her sight had become very poor, and she had difficulty in reading. She also complained of palpitation of the heart on exertion and swelling of the feet. At the time of admission to the hospital, she looked quite ill. She was anemic; the heart sounds were rapid, and there was marked edema of the lower extremities. The tension of the right eye was 55 mm. of mercury (Schiötz) and that of the left eye, 50 mm. In the right eye vision was 6/24, and in the left eye, 6/24.

Ophthalmoscopic examination was difficult owing to the presence of corneal edema, but well marked glaucomatous cupping of the optic disks could be made out. Examination of the visual fields showed advanced glaucoma. The right field was interesting owing to the fact that the blindspot was normal in spite of the advanced depression of the whole peripheral field; the left field showed a small roughly wedge-shaped area extending from the center into the upper temporal quadrant, and the fovea was not involved. There was a relative scotoma extending vertically from the blindspot.

Both eyes were trephined, and the patient was discharged from the hospital on November 16. The tension of both eyes was 18 mm. of mercury. In the right eye vision was 6/9 and in the left eye, 6/12. When the patient was last seen on Feb. 9, 1933, vision was 6/6 in the right eye and 6/9 in the left; the tension was normal in both eyes, and the trephine holes were still filtering. The fields were about the same as those taken on Oct. 26, 1932, except that the relative scotoma extending from the blindspot had disappeared. Ophthalmoscopic examination showed the presence of marked optic atrophy.

CASE 8.—Z. K., a Mohammedan, aged 26, was admitted to the Eye Infirmary on Sept. 17, 1932, with the complaint of defective vision and of seeing rainbow halos with both eyes for about three weeks. The vision in both eyes was 6/18, and there was corneal edema. The tension of the right eye was 60 mm. of mercury and that of the left eye, 55 mm. There were no other signs of epidemic dropsy except slight pitting on pressure of the skin on the dorsa of the feet and the lower third of the legs. The eyes showed deep anterior chambers with semidilated pupils which reacted to light and in accommodation. The patient gave a history of a previous attack of epidemic dropsy in 1926 in which his eyes were

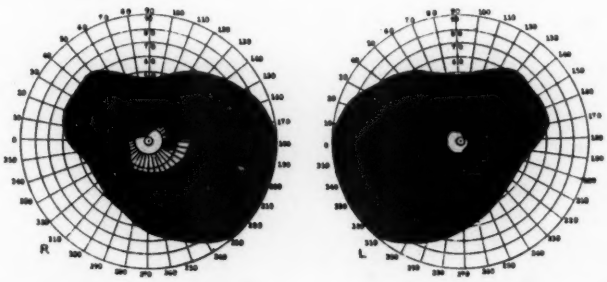

Chart 8 (case 8).—The visual fields on Sept. 17, 1932, before operation. Vision in both eyes was 6/18. The tension of the right eye was 60 mm. of mercury (Schiötz), and that of the left eye was 55 mm. The sizes of the form stimuli were 6/333 and 6/1,000.

also involved. He was treated by his family doctor and recovered. Up to the time of the present attack he had suffered no inconvenience from his defective sight. Ophthalmoscopic examination showed marked glaucomatous cupping and advanced optic atrophy in both eyes. Examination of the visual fields showed advanced glaucoma; only a part of the central fields had escaped. In the left eye the field was limited to within the 10 degree circle. The foveae were not involved in the blind area.

Both eyes were trephined, and the patient was discharged from the hospital on Sept. 30. The tension of the right eye was 18 mm. of mercury and that of the left eye, 20 mm. In the right eye vision was 6/9 and in the left eye, 6/12. When the patient was seen on October 14, the tension of both eyes was normal; the vision was 6/6 in the right eye and 6/9 in the left eye, and the fields of vision were almost the same as before operation.

In this case the patient had apparently suffered from glaucoma in association with epidemic dropsy when he contracted the disease in the outbreak of 1926, as evidenced by the maps of the visual fields. The

duration of the glaucoma in the recent attack was too short to produce such extensive damage to the optic nerves.

CASE 9.—S. N. D., a Hindu, aged 48, was admitted to the hospital on November 28, with the complaint of failing vision and of seeing halos and rainbow colors intermittently for two months. Both eyes were affected. He had no cardiac or gastro-intestinal symptoms. The vision in both eyes was 6/18, and there was slight corneal edema. The tension of the right eye was 50 mm. of mercury and that of the left eye, 40 mm. The patient was a well nourished man, and there were no other signs of epidemic dropsy. Both anterior chambers were deep, and the pupils were semidilated, but reacted to light and in accommodation. There was a previous history of epidemic dropsy in 1920, at which time the patient's feet were swollen and he was confined to bed for a number of weeks. His eyes were also affected, and he distinctly remembered seeing rainbow colors and being unable to read. He was treated in his village and recovered. Ophthalmoscopic examination showed marked glaucomatous cupping and advanced optic atrophy in both eyes. The lenses and media were clear. Examination of the visual fields showed advanced

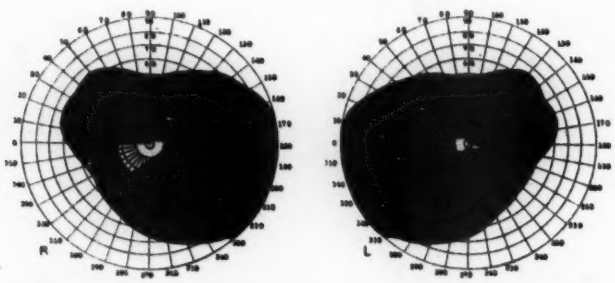

Chart 9 (case 9).—The visual fields on Dec. 13, 1932, after operation. The vision in both eyes was 6/9, and the tension was 16 mm. of mercury (Schiötz). The sizes of the form stimuli used were 3/333 and 3/1,000.

glaucoma, and it was not possible to make accurate charts of the visual fields until after operation. The maps were made on December 13, when the vision had improved to 6/9 in both eyes. The fovea and only a small central area of the visual field in both eyes had escaped.

The pupils were contracted to pinhole size with miotics, but the intra-ocular tension in both eyes remained about the same. Both eyes were trephined, and the patient was discharged from the hospital on December 14. The tension of both eyes was 16 mm. of mercury.

In this case also the patient had apparently suffered from glaucoma at the time of the first attack of epidemic dropsy in 1920. Most probably the optic nerves were extensively damaged at that time, and the damage had extended to its present limits in the recent attack.

Types of visual fields of various kinds are encountered in the glaucoma associated with epidemic dropsy, and for this reason the following case is described.

CASE 10.—S. C. G., a Hindu, aged 30, was admitted to the hospital on Jan. 31, 1933, with the complaint of defective vision and of seeing rainbow rings around lights intermittently for two months. The left eye was first affected, and a month prior to admission the right eye was involved. The patient was suffering from periodic attacks of diarrhea and palpitation of the heart on exertion. He was well nourished. His heart beats were normal, and there were slight corneal edema and slight pitting of the skin on pressure over the dorsa of the feet and the lower thirds of the legs. The vision in both eyes was 6/9; the tension of the right eye was 55 mm. of mercury and that of the left eye, 65 mm. There was no previous history of epidemic dropsy.

Ophthalmoscopic examination showed no evident lesion in the right fundus, but there were glaucomatous cupping and pallor of the temporal portion of the disk in the left fundus. Examination of the visual fields of the right eye showed a wedge-shaped depression of the peripheral field in the nasal quadrants, and the blind area extended into the central part of the visual field around the fovea to

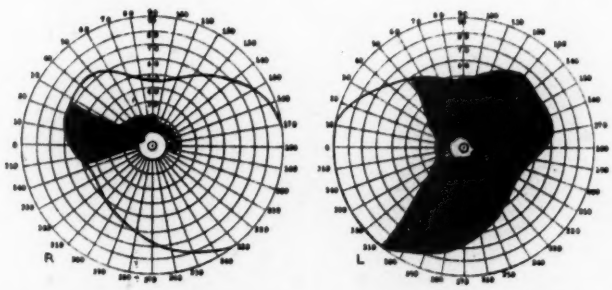

Chart 10 (case 10).—The visual fields on Feb. 20, 1933, after operation. The vision in both eyes was 6/6. The tension of the right eye was 20 mm. of mercury (Schiötz), and that of the left eye was 18 mm. The sizes of the form stimuli were 3/333 and 3/1,000.

meet a large Bjerrum scotoma extending upward from the blindspot. The map of the left visual field showed the presence of advanced glaucoma; both nasal quadrants were completely blind, and the blind area had extended into the temporal quadrants. There was also a Bjerrum's scotoma extending from the blindspot. Both eyes were trephined, and the visual fields were again examined before the patient was discharged from the hospital on February 20. The maps showed practically no change. The vision on that date was 6/6 in both eyes; the tension of the right eye was 20 mm. of mercury and that of the left eye, 18 mm.

The next case is described to show the maps of the visual fields before operation, a short time after operation and eleven months after operation. The charts show only the central and paracentral fields in an advanced type of epidemic dropsy associated with glaucoma which has ceased to progress since the date of operation. The case has been under observation from Jan. 31 to Dec. 29, 1933, and is proof that optic atrophy is due to the increased intra-ocular pressure and not to the toxins of the general disease.

CASE 11.—S. C. G., a Hindu, aged 35, was admitted to the hospital on Jan. 31, 1933, with the complaint of gradual dimness of vision in both eyes for about two months and of seeing colored halos around lights for one month. He gave no history of edema of the feet, diarrhea or cardiac symptoms. On examination, the vision in both eyes, corrected, was 6/6. The corneas were clear, and the anterior chambers were normal. The pupils were equal and active, and the tension of both eyes was 49 mm. There were no other general signs of epidemic dropsy.

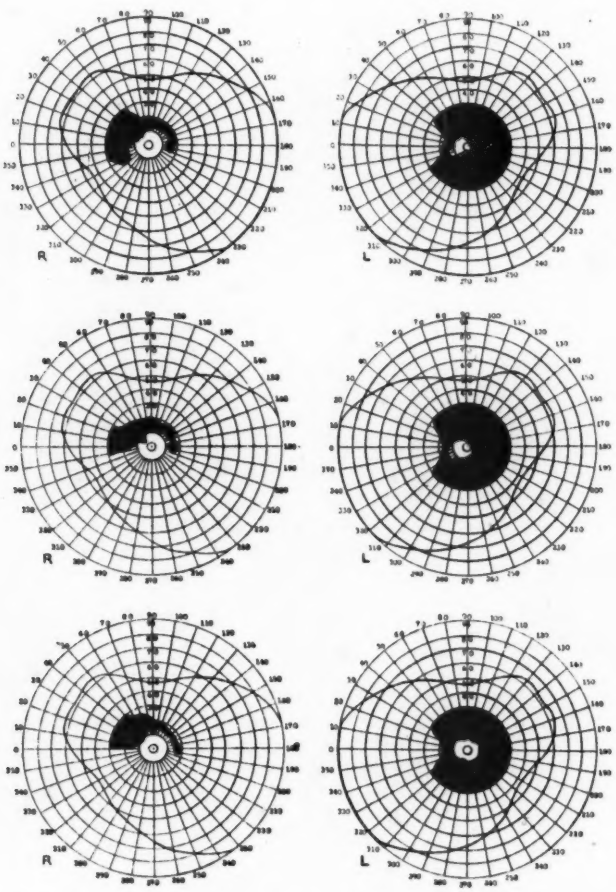

Chart 11 (case 11).—The upper chart of the visual fields was made on Jan. 1, 1933, before operation. The vision in both eyes was 6/6, and the tension was 49 mm. of mercury (Schiötz). The center chart was made on Feb. 20, 1933, after operation. The vision in both eyes was 6/6, and the tension was 22 mm. of mercury (Schiötz). The lower chart was made on Dec. 29, 1933, after operation. The vision in both eyes was 6/6, and the tension was 22 mm. of mercury (Schiötz). The size of the form stimuli was 3/1,000.

Ophthalmoscopic examination showed well marked glaucomatous cupping of the disks, and evidence of optic atrophy, especially in the left eye. Examinations of the visual fields confirmed the presence of extensive optic atrophy. The map of the right field showed that the nasal quadrants were blind. In the central field

there was a well marked Seidel sign; the macula was not affected. The map of the left field showed the nasal quadrants and a large part of the temporal quadrants to be blind, and there was a large Bjerrum's scotoma extending from the blindspot. In spite of the narrowness of the visual field, the fovea had escaped.

Case 12 is described to show the alterations in the visual fields six years after operation.

CASE 12.—J. N. M., a Hindu, aged 38, came to the outpatient department of the Eye Infirmary on Nov. 14, 1932, with the complaint of difficulty in reading. He gave a history of epidemic dropsy which he contracted in July, 1926, when he suffered from palpitation of the heart, swelling of the legs and diarrhea. Three or four months later he commenced to see halos and rainbow colors. His sight gradually became worse, and he was admitted to the Eye Infirmary, where both eyes were operated on in January, 1927. He remained in the hospital about three weeks, and on discharge he had no further trouble with his eyes till recently, when he commenced to have difficulty in reading. On examination it was seen that both eyes had been trephined, but the trephine holes were closed. The vision in both

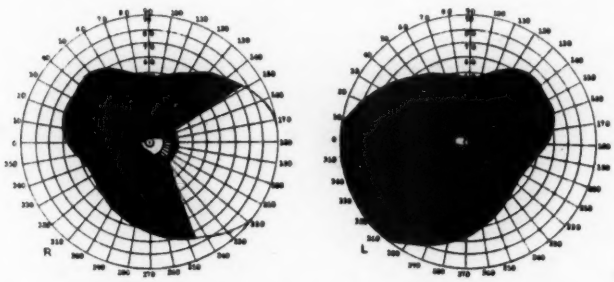

Chart 12 (case 12).—Map of visual fields. The vision was 6/6 in both eyes, and the tension was 18 mm. of mercury (Schiötz). The sizes of the form stimuli were 3/333 and 3/1,000.

eyes was 6/6, and the tension was normal. There was no evidence of a fresh attack of epidemic dropsy. The patient had presbyopia and required glasses only for reading.

Ophthalmoscopic examination showed advanced atrophy of both optic nerves and shallow cupping of the disks. The Wassermann reaction was negative. Examination of the visual fields revealed extensive optic atrophy. The map of the right field showed that both nasal quadrants and a considerable part of the temporal quadrants adjoining were blind. There was a large Bjerrum's scotoma extending from the blindspot. The fovea and a small part of the central field had escaped. The map of the left visual field showed the peripheral field to be blind; only the fovea and a small area of the central field on the temporal side had escaped.

A comparison of these maps with those made in January, 1927, revealed no change.

SUMMARY

Primary glaucoma in association with epidemic dropsy is due to toxins which contain bodies of the histamine group, and the glaucoma is of the chronic primary noninflammatory type. The toxin circulating in

the blood causes a vascular disturbance which upsets in some way the normal function of the intra-ocular capillary endothelium as well as causes dilatation of the general capillary field which leads to an increased output of tissue fluid. As the glaucoma is only part of a generalized disorder, the treatment should be medical if only a speedy method were known to rid the body of the toxins. The operative treatment is symptomatic and is intended to prevent permanent damage being done to the retina by the increased intra-ocular tension till the general disease has been cured by the elimination of the offending toxins. Is the pathologic process of the other varieties of primary glaucoma somewhat similar to that associated with epidemic dropsy? This subject presents a large field for experimental work, and if it is carried out one can look forward to the day when a great part of the problem of glaucoma will be solved by therapeutic measures or methods of prevention.

A PLEA FOR GREATER UNIFORMITY IN METHODS OF FIELD TAKING

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NEW YORK

While the exact standardization of all the steps used in accurate field taking is probably impossible at present, in my opinion, certain steps in the process of taking and recording fields can be rendered sufficiently uniform to enable one more correctly to interpret and more accurately to reproduce published fields than is now possible. Even a superficial review of the literature quickly reveals the importance of an effort in this direction. In the first place, a great variety of test objects are used with little thought of adapting the size of the object to the visual acuity; often little attention is given to the lighting conditions, and the results are recorded incompletely on charts of great variety and of different sizes. In order to make possible the correct interpretation of published fields it is of the greatest importance that the following facts be given in recording fields: the visual acuity, the size and color of the test object and the radius at which that object was used and the quality and intensity of illumination. And yet one of the leading textbooks on perimetry published in this country does not give any of these data for at least half of its fields. It is obvious that such fields are practically worthless.

In the hope of furthering a clearer presentation of this subject, I shall discuss it under the following subdivisions: (1) size and color of test objects, (2) instruments, (3) illumination and (4) charts. I shall then offer a few suggestions as to the routine methods of taking and recording fields.

SIZE AND COLOR OF TEST OBJECTS

Field taking is, in certain respects, an art, but the successful practice of this art depends on a clear understanding of the anatomy, histology and physiology of the visual apparatus, especially of the retina and visual nerve paths. The detection and mapping out of gross defects in the field are easy. Early defects, however, are difficult to detect and to outline, chiefly because the fact has usually been ignored that in any case the visual acuity must determine the size of the test object and the distance at which it must be used, and this, in turn, determines the type of instrument best suited to the taking of any given field. Because this fact is so commonly disregarded, I shall attempt to make clear just why in every case test objects should be selected in sizes suited to the visual acuity.

In order better to illustrate what the field of vision is, Roenne has likened it to a hill or island surrounded by water. The apex of this hill denotes the height of visual acuity, the vision of the fovea, while the low slopes of the hill represent the peripheral portions of the field. The water line represents the extreme limits of the field, or total blindness. Loss of vision in any part of the field is represented by a corresponding depression. A totally blind area would extend down to the water level. The normal blind spot is such a depression. It has been my custom, however, to liken the field of vision to a field or garden of flowers (rods and cones). These flowers are white, red, green and blue. This field of flowers is a special sort of garden that is connected with a castle (the cranium) and is for the exclusive use of the lord of the castle (the brain). This garden is unique in many respects. It is enclosed on all sides, above and below, and has but one window through which the gardener (the ophthalmologist) may, to a limited extent, inspect it and through which also the lord of the castle may enjoy the beauties of the universe as they are reflected in the garden. There are irrigating tubes passing from the castle where the lord of the castle lives into the garden and drainage channels passing from the garden into the castle. The gardener can directly inspect the irrigating and drainage tubes by looking through the window with the aid of a special light, but he cannot see the flowers. In order to determine their condition he must resort to a series of signals, to be shortly explained. It must first be explained that the roots of all the flowers pass out of the garden and into the castle through the same opening that admits the drainage and irrigation pipes, and that whenever light shines on the flowers through the one window, electrical impulses are carried to the lord of the castle through these specially constructed roots and he thereby enjoys the beauty of the entire panorama that is spread out before the window of this fairy garden. For full information concerning the vigor of the flowers in his garden, however, the lord of the castle must rely on his gardener who has learned that by throwing the shadows of certain objects of varying color and size on the flowers, electrical impulses are sent to the lord of the castle and he thereby knows whether the flowers are alive. If no signal is received, he knows that the flowers in that area are dead or damaged. The gardener has learned that in order to obtain a response, the shadow of his test object must fall on at least a part of two living flowers. Therefore, in order to detect a beginning death of the flowers he must use an object having a shadow not larger than the diameter of one single flower, for he has learned that half of the flowers of the garden could be destroyed in such a way that the remaining flowers would still be equidistant, that is, if every second flower were destroyed; he also knows that under such an arrangement an object casting a shadow not

greater than two times the diameter of a single flower would still fall on two living flowers, and both the gardener and the lord of the castle would be deceived into believing that no flowers had died.

Regarding the eye itself, how can the gardeners in ophthalmology be guided in field taking so as to be able to detect the earliest changes in the field of vision?

In an article published in 1926 I[1] stated that in order to detect a beginning scotoma, one should use the smallest normally perceptible object for the particular field area under examination. Snellen considered the smallest normally perceptible object for central vision to be an object subtending an angle of 1 minute. It was on this assumption that he determined the size of characters for measuring visual acuity. But it is now known that a much smaller object can normally be seen at the macula. Roenne and Traquair[2] stated that a one-half minute object can be seen at the macula. Starling[3] stated that the physiologic point is 24 seconds. Howell[4] says that the smallest normally visible object forms at the macula an image having a diameter less than that of 1 cone, or less than one-half minute.

Just as Snellen was guided by what he considered the limit of visual acuity in deciding the size of letters to be used in testing visual acuity, so, in field taking, one must determine the size of the test object by the limits of visual acuity. A one-half minute object at 4 meters measures a little more than 0.5 mm. (0.63 mm.). But a still smaller object can normally be seen at the macula; namely, a 0.5 mm. object can be seen at 4 meters. Such an object forms at the macula an image having a diameter less than that of 1 cone. The diameter of a cone at the macula is 0.002 mm.[5] and these cones are so closely packed together that they are hexagonal on cross-section and have no intervening tissue. Assuming that each cone has a diameter of 0.002 mm., 500 cones in a row would form a line 1 mm. long, and there would be 500 such lines in 1 sq. mm., making about 250,000 cones to the square millimeter. A one-half minute object forms a retinal image measuring 0.002 mm. in diameter, or just large enough to cover 1 cone. A 1 minute object

1. Thomasson, A. H.: A Simplified Tangent Screen with Suggestions on Field Taking, Arch. Ophth. **55**:545 (Nov.) 1926.

2. Traquair, H. M.: An Introduction to Clinical Perimetry, St. Louis, C. V. Mosby Company, 1927, p. 8.

3. Starling, Ernest H.: Principles of Human Physiology, ed. 3, Philadelphia, Lea & Febiger, 1920, p. 559.

4. Howell, William H.: A Text-Book of Physiology for Medical Students and Physicians, ed. 3, Philadelphia, W. B. Saunders Company, 1933.

5. Howell,[4] p. 336. Starling[3] stated that the diameter of the cones is between 0.002 and 0.003 mm. and that objects can be perceived as separate whose retinal images are separated by only 0.0018 mm., having an angle of only 24 seconds.

forms a retinal image of 0.004 mm. in diameter, and, if square, would be just large enough to cover 2 cones in each direction, or 4 cones. A 1.25 mm. object at 4 meters forms an angle of 1 minute. In searching for the proper sized object to detect a beginning loss of central vision, it may be assumed that in order to be perceived a retinal image must touch at least 2 living cones at the same time. I think that this assumption is correct, for I have seen cases in which a 0.5 mm. object was seen out to about 2 meters. Beyond that distance the 0.5 mm. object was not seen, but a 1 mm. object used in the same field area was. Now if the stimulation of 1 cone caused an object to be perceived, the 0.5 mm. object would have been perceived beyond 2 meters whenever its image covered 1 living cone, as was the 1 mm. object which at that distance covered about 4 cones, 2 of which must have been sensitive.

If, then, a retinal image is perceived only if it touches at least 2 cones at the same time, it may also be assumed that in the macula of a given patient one half of the cones have been destroyed in such a way that the remaining cones are equidistant from each other, every second cone having been destroyed. Since a one-half minute object forms a retinal image having the same diameter as 1 cone, it is obvious that such an object will not be seen and a scotoma will therefore exist. The image of a 1 minute object will cover 4 cones, 2 of which are still living and able to perceive the image. No scotoma can therefore be revealed with an object of this size in this case. Hence the 1 minute object, measuring only 1.25 mm. when used at 4 meters, is too large to detect a loss of 50 per cent of the cones at the macula under these conditions. What, then, can be said of ophthalmologists who habitually use very large test objects and still think that they are actually measuring the degree of visual loss?[6]

In spite of the excellent work of Bjerrum, Roenne, Traquair, Walker and others, in showing the necessity of using small test objects for the detection of early scotomas, I contend that the average ophthalmologist has not yet grasped the reason for their use. In an excellent article

6. I once heard an internationally prominent teacher of ophthalmology state, concerning the field of vision in a certain type of disease, that whenever the field became contracted to within 10 degrees he always changed the treatment. I asked him what size object he used and at what distance. I had frequently seen him taking fields and knew that he used the ordinary type of perimeter at 33 cm. In replying he used these words: "Whenever I take a field I always use a 10 mm. object." I could scarcely refrain from asking him whether he had ever tried a golf ball for this purpose. It would have been just about as useful. Think how blind one must be who can only see a 10 mm. object out to 10 degrees at a distance of 33 cm.! This incident did not happen in America, but I often think it would be possible even here.

published in 1931 Ferree, Rand and Sloan,[7] who are recognized authorities on this subject, advocated the use of colored instead of white objects for the detection of early scotomas and stated that the white stimuli used for this investigation measured 1 degree (60 minutes), 0.5 degree (30 minutes) and 0.17 degree (10.3 minutes). The smallest white object used by them was a 10.3 minute object, while it has just been stated that under certain conditions a 1 minute object is too large to detect a scotoma after a loss of 50 per cent of the cones in the macula. How can they possibly hope to detect the beginning of a scotoma when their smallest white object has a diameter more than twenty times as great as the smallest normally perceptible object? At least a one-half minute object must be used to detect the beginning of a loss, and their smallest object was a 10.3 minute object.

So far white stimuli have been considered. It was stated that at the fovea a 0.5 mm. white object can normally be seen at 4 meters. At 1 meter this object can be seen to about 20 degrees. A 1 mm. object at this distance can be seen to about 30 degrees. The chief function of the peripheral field areas is to detect the movement of objects, and not to study their details; therefore it is not necessary to use very small objects in plotting these areas. A 5 mm. white object is probably the most suitable for plotting areas beyond 25 degrees. For these areas a larger object is seldom necessary.

Colored Test Objects.—Any scotoma that can be detected with a colored object can also be traced with equal ease and accuracy with a white object if it is sufficiently small. White objects have approximately ten times the visibility of colored objects. The isopter of a 0.5 mm. white object should approximate that of a 5 mm. colored object, and the isopter of a 1 mm. white object, that of a 10 mm. colored object. This is, of course, only a rough approximation of the relative values of white and colored objects. In comparing white with colored objects, the comparison may begin with the smallest normally perceptible white object and the smallest normally recognizable colored object. In charting fields one notes the point in the field of vision at which the white object is first seen and at which the color of the colored object is first correctly recognized.

In my opinion so many errors are possible in the use of colored objects that their use should be almost entirely restricted to attempts at differential diagnosis, as in efforts to determine whether the percipient or the conductive apparatus of the retina is involved, to the differential diagnosis of toxic amblyopia from other lesions of the optic nerve, or to the differentiation of certain lesions of the brain. One of the more important objections to the routine use of colored stimuli is the fact

7. Ferree, C. E.; Rand, G., and Sloan, L. L.: Sensitive Methods for the Detection of Bjerrum and Other Scotomas, Arch. Ophth. **5**:224 (Feb.) 1931.

that in many people with normal vision, and apparently otherwise healthy eyes, the ability either to perceive or to interpret colors varies greatly. Also, it is difficult to obtain colors of uniform tint or saturation, and even the best colors tend to fade in time. A suitable working set of test objects should be made up of at least two each of the following sizes and colors: white, 0.5, 1, 2 and 5 mm.; red and green, 1, 2 and 5 mm.; blue, 5 mm. A satisfactory set of test objects has been made by Dörffel & Faerber, of Berlin, according to specifications drawn by me. I also recommend the excellent set of spherical test objects designed by Dr. Conrad Berens and sold by E. B. Meyrowitz, 520 Fifth Avenue, New York.

INSTRUMENTS

Since the smallest normally perceptible object must be used in the detection of early scotomas, and the smallest normally perceptible white object is approximately a 0.5 mm. object at 4 meters, and since smaller objects are not obtainable, it is obvious that an instrument for mapping out the central field area must be capable of use at this distance if white objects are employed. The tangent screen is the only instrument capable of use at this distance and is, therefore, necessary for this part of the work. This is true, not only because in the detection of beginning scotomas the test object must subtend a very small angle, which can be obtained only when the object is used at a great distance from the eye, but also because one should have a great magnification of the scotoma, which can be obtained only when the instrument is operated at a considerable distance from the eye. It is almost, if not entirely, impossible to map out accurately early scotomas of the central field area at a radius less than 1 meter. For the plotting of areas beyond 25 degrees a perimeter with a radius of 33 cm. is satisfactory. Such an instrument is practically indispensable for this work. The more simple its construction, the better. These two instruments, therefore, are the only ones needed for accurate field work, but these are necessary. Stereoscopic instruments for use at a short radius are useful for the detection and rough plotting of advanced defects but are not in any way equal to the tangent screen for the early detection of scotomas or for accurately outlining any scotoma.

ILLUMINATION

Of late much has been said and written concerning the proper illumination of fields. It seems to be the general opinion that daylight is too variable and uncertain to be relied on, and that, therefore, some mode of artificial illumination should be generally adopted. I cannot yet bring myself to accept this opinion. Daylight is the natural environment, and to a surprising degree man has learned to adapt himself to its constant variations. In the great open spaces, on the prairies, in the

mountains or at sea, where one's view is not obstructed, moderate reduction of illumination by clouds causes but little reduction of visibility. Under such conditions, small objects, such as game, birds or other small or distant objects can be seen as readily and distinctly on a moderately cloudy as on a clear day, provided there is no haze or fog. Mere reduction of illumination has little effect on fields taken with white test objects unless the illumination is reduced to 3 foot-candles. One seldom meets with reductions in illumination greater than this if fields are taken between 9 a. m. and 3 p. m. The following case will illustrate this point:

A. W., aged 22, was examined by me at 9 a. m. on Dec. 24, 1933, by daylight illumination, northeastern exposure, during a fog so dense that, although my office is on the fifth floor of a building within two short blocks of the water front, the water could not be seen, nor could any vessel be seen on the water, and no hint of the position of the sun in the sky could be made out. The fog did not penetrate into my office, but it is obvious that the light was much subdued. Yet the results of my examination were essentially the same as on other days when the sky was clear. Vision on the right was 20/15; on the left, 20/20— not improved. In testing for a central scotoma, a 0.5 mm. white object was used. With the right eye this object could be seen against a black background at a distance of 15 feet (4.5 meters) out to a little over 1 degree. The left eye could see this objejct centrally at 8 feet (2.4 meters); beyond this distance a central scotoma could be demonstrated to a distance of about 12 feet (3.6 meters) where the object disappeared. The refractive media were clear in each eye, and the fundi were normal. The scotoma in the left eye was probably due to a congenital defect in the fovea.

In my opinion the ideal illumination for field taking is from a northern exposure on a clear day and between 9 a. m. and 3 p. m., as stated. The light should come from as large a window as possible, or preferably from two windows close togther, the patient being seated between them. While my chief reason for advocating daylight illumination is that I think it superior to any form of artificial illumination, I also favor it because I believe that if a widespread effort were made to substitute artificial for daylight illumination such a variety of instruments would come into use, giving such varying intensities and qualities of illumination, that the total result would be far inferior to daylight illumination. It is of far greater importance that records state the quality and intensity of illumination used than that every one employ the same intensity and quality of illumination. In cases in which good daylight illumination cannot be obtained, some mode of artificial illumination becomes necessary. In such cases it is advisable to illuminate the screen or perimeter from two sources of light, one directed over each of the patient's shoulders; also, the light should be from the so-called daylight bulbs, which reveal colors to better advantage. An intensity of about 7 foot-candles is probably best. Before deciding on this mode of illumination, a lighting expert should be consulted.

Field taking by subdued light accomplishes but one purpose, the obscuration of the stimulus. More accurate results may be obtained by using smaller objects at a greater distance from the eye. Perimetry in an absolutely dark room, using a small, dim light as a stimulus, is simply a test of the rods, the sensitiveness of which is increased 200,000 times under such conditions, if full dark adaptation is reached.[8] In absolute darkness the cones are insensitive to dim light, and a central scotoma is present.

CHARTS

The charts should be similar in design for all instruments. The simplest and best chart is the one which has long been used, with meridians crossing at the fixation point and concentric circles representing degrees, outward from this point. Fields drawn on charts made up of squares are much more difficult to transfer and are less easily interpreted. Charts for the tangent screen should be identical in design with the chart on the back of the screen, but every second radiating line should be shorter than its fellow. These shorter lines serve as landmarks and facilitate transferring fields from the screen to the chart. Having the back of the screen and the chart of similar design renders transfer from the screen to the chart more rapid and accurate. Charts for the stereoscope should be of similar design but printed on neutral gray paper or cardboard. This color is less fatiguing to the retina, and test objects of white, black or colors are readily seen against it. I advise that charts for the perimeter and tangent screen be printed on reverse surfaces of the same sheet of paper or card. This saves space in filing and encourages the use of each instrument in the taking of all the fields. I mentioned previously that only two instruments are necessary in field work: a perimeter, preferably of simple design, and a tangent screen.[9]

ROUTINE STEPS IN FIELD TAKING

Before taking a field the patient's eyes should be carefully examined and refracted. In the examination, special care should be taken to

8. Villiger, W.: The Zeiss Planetarium, London, W. & G. Foyle, Ltd., 1926, p. 48.

9. Since this article was written I have read the report of the Committee on Standardization of Perimetry of the International Congress of Ophthalmology given at the session at Amsterdam in 1929. The recommendations in this article are in accord with the recommendations of that committee, except that with reference to tangent screen and perimeter charts I here advocate charts designated for use by the anatomic method of field taking and nomenclature. Charts of this type were first introduced in America and regularly used by Dr. Herman Knapp more than forty years ago, and they are now advocated by Troncoso and Peter. Dr. Peter was the American member of the committee; he offered a minority statement advocating this method of nomenclature. The charts here described are published by the Peck Press, 314 East Twenty-Third Street, New York.

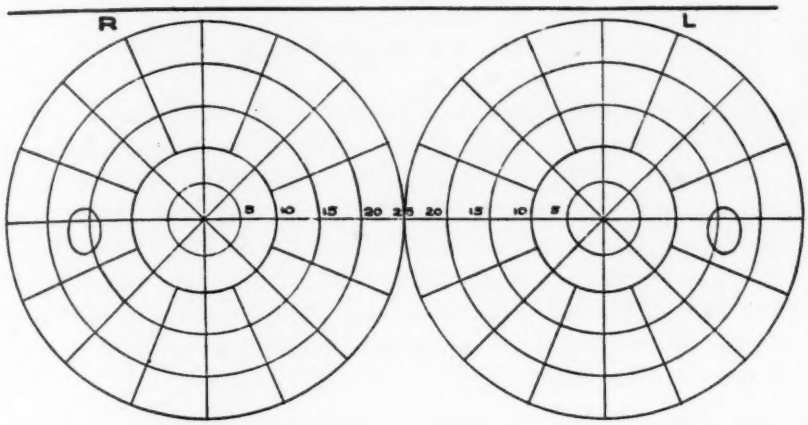

Fig. 1.—Tangent screen chart for use with the tangent screen designed by the author, at a distance of 1 meter.

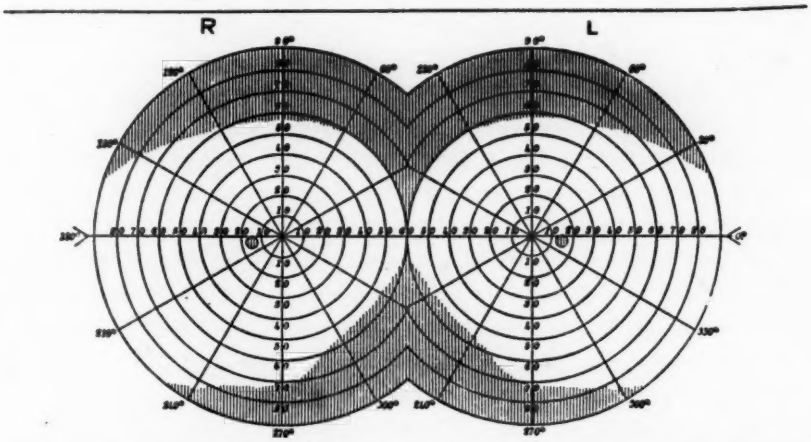

Fig. 2.—Perimeter chart. Usual design in use by American ophthalmologists for many years, but with shading recommended by the publishing department of the American Medical Association and with designations *R* and *L* to conform to the anatomic method of field taking.

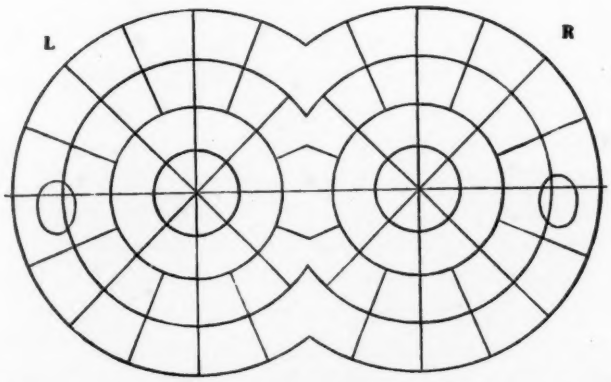

Fig. 3.—Chart for use with any wide angle stereoscope or campimeter at a distance of 18 cm. The chart should be printed on neutral gray paper.

detect any cloudiness or opacities of the cornea, lens or other refractive media. Large, dense opacities of the cornea often cause abnormal irregularities in the field of vision, and if their presence is not known, may lead to erroneous interpretations. The same may be true of cataracts with dense peripheral spokes or central stellate figures more dense than the remaining substance of the lens. The fundus should also be examined, if this is possible. Ordinarily, if distance glasses are worn, these should be worn during the examination. In the case of presbyopic patients it is often advisable to set up special glasses in a trial frame, focused for the distance at which the examination is made. The lenses should be large, and they should be placed as near the patient's eyes as is possible without producing annoyance. If daylight illumination is to be used, the patient should be seated in a comfortable chair in front of and close to a large window, not exposed to the direct glare of sunlight. A nc thern exposure is best. If especially great accuracy is desired, a chin and head rest, such as is used in an examination with a slit lamp, should be used, but many patients are more restless with a head rest, and good work can be done without it. The purpose and methods of the examination should be carefully explained to the patient.

As a routine I always examine the right eye first. The peripheral field should be carefully gone over first by the confrontation method with a 5 mm. white object. It is my opinion that all operators should thoroughly master this method of examination. It is a great time-saver in examining the peripheral areas of the field, and often does away with the necessity of using a perimeter. In going over the peripheral area, at least eight meridians should be followed through. On each meridian examined, the point at which the object is first seen at the periphery should be noted on the chart and then the object should be carried along this meridian toward the point of fixation to about the 25 degree circle. Each of the eight or more meridians to be examined should be followed through in this manner, and if any defect or suggestion of a defect is discovered, the entire peripheral area should be more carefully gone over with the aid of a standard perimeter at 33 cm., leaving the central area from the fixation point out to 25 degrees to be mapped out on the tangent screen with the aid of smaller test objects, at a distance of 1, 2, 3 or 4 meters. The results of the perimeter (or confrontation) examination should be carefully recorded on a special chart for the perimeter. The points to be recorded are: the central visual acuity, as, 20/20; the size and color of the test object and the distance at which it was used, as, 5/330 white (the numerator of this fraction indicates the size of the test object, and the denominator indicates the distance in millimeters); illumination, as, daylight, 10 a. m., fair, northern exposure, or artificial illumination, 7 foot-candles, daylight bulbs. The name and age of the patient, the diagnosis, and the date

of the examination should also be stated. This information is of as much importance as the accurate charting of the field. Without this information fields cannot be correctly interpreted or reproduced.

The central field area should then be mapped out with the aid of a tangent screen. The patient should be seated in a comfortable chair with a straight high back, and preferably with a head rest or with a head and chin rest. The distance at which the screen should be used depends on the visual acuity of the subject. If the vision is 20/20 or better, I usually begin with the screen at 1 meter, using as a fixation object a 3, 4 or 5 mm. dull black-headed pin (mourning pin), in the center of a neutral gray disk of cardboard or cloth, 10 or 20 mm. in diameter, depending on the visual acuity of the patient. At present I am using a screen covered with black broadcloth. I first outline the blind spot, using a 1 or 2 mm. white object. The outlining of the blind spot at the beginning of the examination is important. It teaches the patient to expect the test object to disappear and reappear at times, and enables the operator to go back to the blind spot from time to time to assure himself that the patient is fixing. In mapping out all scotomas the test object should always be carried from the blind to the seeing area. If it is carried in the opposite direction the patient has a greater temptation to follow the object and the persistence of the retinal image may lead to a slight error, causing the scotoma to appear smaller than it really is. If glaucoma is suspected, as soon as the blind spot has been outlined as described, the areas just above and below, in the exact situation where the glaucoma scotoma usually first appears, are carefully examined with a 0.5 mm. white object, first at 1 meter and then at 2 and 3 meters. If a central scotoma is suspected, I carefully examine the center of the field in the same manner with a 0.5 mm. white object at 1, 2, 3 and 4 meters. In this case it is well to confirm the result with a 2 mm. red or green object at 2 or 3 meters. If, under these conditions, no scotoma is found, it is safe to assume that none is present. In the examination of the center of the field it is well to keep in mind the area of the field where scotomas are most commonly found, the scotoma triangle, described in a former article.[1] This area should be most carefully gone over with a small test object. If the triangle contains no scotoma and if the ophthalmoscope reveals no lesion that could cause a scotoma, it is reasonable to assume that none is present. In some cases of defects of the field, however, due to occlusion of a branch of a retinal artery and in certain lesions of the brain, the fundus may appear normal on examination, but these defects usually extend to the periphery and are found by the aid of the perimeter.

If the visual acuity is considerably reduced, larger test objects must, of course, be used, the size being determined by the visual acuity. Throughout the examination, especially while using the tangent screen,

care should be taken that the patient is not unduly fatigued or annoyed. This applies to both retinal fatigue and general nervous exhaustion. It is also important to make sure that perfect fixation is maintained at all times. As soon as the examination is completed, a full and detailed statement of the conditions under which the field has been taken and of the results should be made on the special chart designed for this purpose.

If the suggestions here offered—especially those referring to the types of machines to be used and to the accurate and complete recording of all the data relating to each field so taken—were more generally adopted, the results, I am sure, would be more uniform, and the interpretation and reproduction of published fields would be made much easier.

NEOPLASMS OF THE LACRIMAL GLAND

WITH A REPORT OF TWO CASES

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It has been three hundred and thirty-four years since the first case of tumor of the lacrimal gland was reported by Fabricius Hildanus,[1] who treated the growth successfully. From this period until 1901, when Warthin [2] reviewed and classified the reported cases, which numbered 132, knowledge concerning the pathology of the individual tumors was in a chaotic state. The first authentic microscopic examination of a tumor was made in 1867. Before that time tumors were diagnosed from macroscopic examination and a study of their clinical course. It is no wonder that there were many errors in the pathologic classification when one considers that enlargement of the lacrimal gland, apart from neoplasms, may be caused by inflammatory swellings, cystic dilatations and simple hypertrophy, while secondary enlargement may be associated with Mikulicz's disease and leukemia.

The 132 cases classified by Warthin [2] were later reviewed by Lane,[3] who found that 15 were characteristic of Mikulicz's disease. By further search through the literature she was able to add 112 cases of neoplastic tumors of the lacrimal gland by 1922. Since 1922, 34 additional cases have been reported, bringing the total number to 263 at the present time. This does not include the 2 cases reported in this article.

PATHOLOGY

Warthin [2] believed that the majority of tumors were of the mixed variety and were endothelial in origin, springing from the flattened endothelial cells of the lymph spaces. He suggested that they be classified according to their structural characteristics and their histogenesis, such as myo-endothelioma. Verhoeff,[4] in his report, although agreeing

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1. Fabricius Hildanus: Observationes Chirurgicae, 1598.

2. Warthin, A. S.: A Case of Endothelioma of the Lacrymal Gland, Arch. Ophth. **30**:601, 1901.

3. Lane, L. A.: A Study of Tumors of the Lacrimal Gland, with Report of a Mixed Tumor, Am. J. Ophth. **5**:425 (June) 1922.

4. Verhoeff, F. H.: The Mixed Tumors of the Lacrymal and Salivary Glands, J. M. Research **8**:319, 1904-1905.

that the majority of tumors were of the mixed variety, differed from Warthin in that he believed that these tumors arose from the anlage of the lacrimal gland and considered them as congenital epithelial tumors. The mode of origin is still in dispute, but further reports by Birch-Hirschfeld [5] and others present more conclusive evidence favoring the epithelial origin.

In classification of the tumors of the lacrimal gland, many types have been described, with the mixed type by far the most common, in which the histologic make-up varies greatly within the same tumor. It is no wonder that considerable confusion arises in attempting to classify a tumor, when one realizes that the histogenesis, type and arrangement of tissue and clinical course are all considered in determining the classification. Pfingst [6] stated that although the majority of tumors are made up of heterogeneous tissues and should be regarded as mixed tumors, there are cases in which the parenchyma has one predominating structure, and in such cases the nature of the prototypal cell should decide the species of the tumor.

CLINICAL COURSE

The neoplasms usually develop slowly, the history dating back from one to five years in most instances. They appear in patients past middle life in most cases, but may be found in the young, in whom they are usually rapidly fatal. The first sign is exophthalmos, which may develop slowly or rapidly and which is usually noticed at first by some one other than the patient. Often the vision is not greatly disturbed, but later it may be defective, owing to hyperemia of the papilla, pressure atrophy of the optic nerve or a high degree of astigmatism resulting from pressure on the cornea. There may be an early history of pain. At first the extra-ocular movements may be normal, but as the condition progresses the movements up and out are restricted, and as the tumor enlarges further the globe is pushed nasally, with the long axis down and in. If the area about the lacrimal gland is palpated, a hard mass may be felt, which may be movable. However, the tumor may grow to considerable size before it can be felt, and it may be necessary for the patient to be anesthetized in order to allow the physician to palpate deeply enough below the ocular margin to feel the tumor. With eversion of the upper lid, a mass may often be seen in the lateral portion of the upper fornix conjunctivae. With the use of the exophthalmometer the presence and amount of proptosis may be

5. Birch-Hirschfeld: Zur Kenntnis der Mischtumoren der Tränendrüse, Arch. f. Ophth. **90**:110, 1915.

6. Pfingst, A. O.: Neoplasms of the Lacrimal Gland, Arch. Ophth. **55**:139 (March) 1926.

measured. This procedure is useful in that any increase in exophthalmos may be noted at subsequent examinations. Roentgenograms are helpful in determining the presence of destruction of the bony orbit. Examination of the fundus usually gives negative results.

That tumors of the lacrimal gland are fatal in many cases was shown by Lane [8] in a review of 95 cases which showed a death rate of 12.63 per cent and recurrences in 20 per cent. It is, therefore, exceedingly important to remove the tumor completely at operation, which should be performed as soon as possible.

TREATMENT

The treatment of choice is removal of the tumor in such a way that the eyeball may be retained and the normal extra-ocular movements preserved. It should be remembered that mixed tumors show a low grade of malignancy in their earlier stages and are important only regionally. However, if they are not completely removed they will recur repeatedly and show a higher degree of malignancy. It is important, then, to save the eyeball only if it is certain that the tumor has been completely removed.

The surgical approach may be either an incision through the upper lid along the upper lateral orbital margin or the Krönlein approach. The former method may be sufficient for tumors of smaller size and is advantageous in that it is much simpler and leaves practically no deformity or scar. With a tumor of larger size, it is necessary to use the lateral approach devised by Krönlein, which allows freer dissection to remove the tumor completely.

One should not be hesitant about the postoperative use of irradiation to destroy any portion of the tumor which may remain. This is especially true in cases in which the neoplasm either is not definitely encapsulated or shows signs of infiltrating the surrounding tissue or bone.

REPORT OF CASES

I wish to report 2 cases of tumor of the lacrimal gland: the first a true mixed tumor and the second an adenocarcinoma. The patient with the adenocarcinoma had associated syphilis, which presented an interesting problem for differential diagnosis.

CASE 1.—G. S., a white woman, aged 31, presented herself for the first time in July, 1931, with a chief complaint of gradual protrusion of the right eye, which was first noticed in the fall of 1927. The condition had developed gradually, and at first had seemed improved when the patient rose in the morning, but became more pronounced during the day. During 1930, the eye protruded more markedly, and the patient submitted to one treatment with radium, which did not improve the condition. Her past history was irrelevant.

#269,222

External examination showed the following: The right palpebral fissure was larger than the left. The lower lid extended to within 3 mm. of the limbus below and to within 2 mm. of the limbus above. The extra-ocular movements were normal. With the exophthalmometer, the exophthalmos measured 24 mm. in the right eye and 18 mm. in the left. The anterior ciliary arteries were dilated, and the conjunctiva of the eyelids was hyperemic, but there was no edema of the lids. Examination of the cornea and anterior chamber gave negative results. On eversion of the upper lid, the lacrimal gland could be seen temporally covered by conjunctiva; the blood vessels over this area were slightly dilated. Along the upper outer third of the orbital margin a firm mass could be felt, which was adherent to the bone. It extended downward to the external palpebral ligament and involved the lateral third of the eyelid.

Ophthalmoscopic examination gave negative results. Vision was 6/30+1 in the right eye and 6/10+3 in the left, without refractive improvement. The pupillary reflexes and fields of vision were normal. The Kahn reaction of the blood was negative, and the urine was normal.

The condition was diagnosed as tumor of the lacrimal gland, and operation was advised. The patient refused this procedure, but returned in August, 1933, at which time the findings were similar to those at the previous examination.

On August 13, a Krönlein operation was performed on the right orbit under avertin anesthesia. On exposure of the lateral side of the orbit, a small oval tumor about 25 mm. in diameter was found lying in the upper outer portion of the orbit against the wall, its anterior third extending beyond the orbital margin. It was freed by blunt dissection and was found to lie at the side of, and behind, the globe and directly against the external rectus muscle. The periorbita was included in the fibrous capsule. The entire tumor was removed, and the wound was closed in the usual manner.

The postoperative course was uneventful. Twelve days following operation the wound was well healed, with practically no deformity. The extra-ocular movements were normal, and ophthalmoscopic examination gave negative results. The exophthalmometer readings were 18 mm. for both the right and the left eye.

The department of pathology of the University of Michigan examined the excised tissue and submitted the following report: The tumor was grossly 25 mm. in diameter and consisted of firm white cellular material. Microscopically, it was shown to be a mixed tumor of the lacrimal gland, with the same general structure as mixed tumors of the salivary gland, including cartilage and myxomatous stroma. While the tumor was not carcinomatous histologically, it would have recurred unless it had been entirely removed and eventually would have taken on malignant characteristics.

CASE 2.—W. T., a white man, aged 49, gave a history of having been in an automobile accident one year previous to admission to the University Hospital. One month following this accident his wife noticed protrusion of the right eye. Since that time the proptosis had gradually increased, with no associated pain, loss of vision or inflammation.

Neurologic examination revealed the gait to be practically normal; the pupils were equal but did not react to light; the achilles jerks were not obtainable; there were diminished tenderness of the tendo achillis and extension of the toes on plantar stimulation.

Ophthalmologic examination showed the following: The eyes were straight, and the extra-ocular movements in the involved eye were restricted in all directions. The palpebral fissure was wider on the right than on the left. There were no

swelling of the lids, no congestion and no point of tenderness. No mass was felt between the globe and the orbital rim. The fundus was normal. There was marked resistance to pushing the right eye into the orbit. Vision was 6/30 in both eyes. Roentgen examination revealed destruction of the medial and superior portion of the right zygoma, with no abnormality in the appearance of the optic foramen.

Laboratory examination showed normal urine and normal blood cell estimations. The Kahn reaction of the blood and spinal fluid was 4 plus.

Because of the positive Kahn reaction of the blood and spinal fluid, along with a diagnosis of dementia paralytica, the possibility of an orbital gumma had to be ruled out before operation for tumor of the lacrimal gland could be decided on. The patient was given a therapeutic course of potassium iodide and mercury, with no improvement in the proptosis. A diagnosis of tumor of the lacrimal gland was then made, and removal was advised.

A Krönlein operation was performed under avertin anesthesia. A hard mass could be felt behind the equator of the globe laterally and superiorly in the region of the lacrimal gland. On exposure of the orbit, the tumor mass, which was diagnosed as an adenocarcinoma by frozen section, was found to occupy the lateral, superior and posterior portions of the orbit and to be definitely adherent to the optic nerve. Exenteration was completed, and an eroded area on the lateral portion of the orbit was cleaned with biting forceps and then coagulated with diathermy, diathermy being used also at the fissures. Gauze smeared with petrolatum was then packed into the orbit. One week following operation roentgen therapy was instituted in the form of cross-firing from four sides, with a total of 800 roentgens to each port, one port each day.

#323,309

The tumor was diagnosed pathologically as a medullary carcinoma composed largely of prickle and squamous cells, with a moderate pseudoglandular architecture. At the periphery of each nest there was a layer of cells with a polar arrangement like that found in the adamantinomas. The stroma was in part hyaline and in part mucinous. This carcinoma undoubtedly arose from a mixed tumor of the lacrimal gland, and at the time of operation was locally malignant. It would have continued to recur if it had not been entirely removed.

CONCLUSIONS

Two cases of tumor of the lacrimal gland are reported, one of which was of the true mixed variety, the other an adenocarcinoma which probably arose from a mixed tumor. The latter case presented complicating syphilis, necessitating differentiation of the tumor from probable orbital gumma.

Tumors of the lacrimal gland should be removed in their entirety. If pathologic examination reveals malignancy, irradiation should be instituted to supplement the surgical procedure.

PSYCHOGENETIC DISTURBANCES OF VISION

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AUTHORIZED TRANSLATION AND ABSTRACT BY LOUIS S. LONDON, M.D., NEW YORK

Two persons receiving the same ocular impression see a different picture. One perceives the world according to inner laws, regardless of the fact that the object itself is a constant quantity, according to Kant. Vision is biased. One person sees something that escapes another's attention.

I long ago found out that visual memory has specific qualities. Although I am a practicing physician, I have found it hard to remember faces of my patients, but whenever I meet them in the street I am able to identify them at a distance by their movements.

A surgeon admitted that he was never able to identify his patients by their faces but only by the cicatrix left by the incision.

One overlooks many impressions if one is inwardly distracted from the outer world. Although I am interested in architecture, I have overlooked buildings in Vienna in a neighborhood which I have traversed thousands of times.

Pregnant women notice other women in the same condition, whereas formerly they did not; women in mourning observe others in the same clothes.

One sees only what one wishes to see; one notices only what interests one.

The inner emotions—because interest is a question of emotions—determine our perception of the world. Therefore, fetishists discover only objects toward which their sexual interest is directed. A foot fetishist only looks at that part of the world which is close to the ground. He looks everywhere at shoes and perhaps goes so far as to look at stockings, but the rest does not interest him. An eye-glass fetishist, looking for women wearing heavy glasses, scans every face until he has found his ideal. He passes beautiful women, but they do not interest him.

I treated a man who was interested only in persons with swollen cheeks or in those wearing a bandage. He ran up and down the streets to find the object of his desire or waited for hours in front of a dental clinic, because here he would be gratified sooner or later. He spent three months in Vienna. I do not believe that he received any lasting impression of the buildings, museums and gardens. But the sexual

objects were accurately registered and remained anchored in his memory as indelible impressions.

There are persons who want to see only the part of the world close to the ground. They never climb mountains, but they will lie down in a field and stare into the sky; the opposite type seeks the bird's-eye perspective. Both types appear to be psychically determined. The fact must be taken into consideration that many persons sexualize nature. One sees that plainly in the landscapes of great artists who express their sexual desires and psychic conflicts in their paintings. This also confirms Goethe's profound saying: "All things transient are but a parable."

The concentric limitation of the field of vision, in neurotic persons and people who have suffered a traumatic shock, should be regarded as an objective indication of a functional disease. It was Janet who proved that this concentric limitation of the field of vision can be traced to an overvalued fixed idea. Freud proposed the phenomenon of conversion (phychic conflicts are converted into corporeal symptoms). Psychologists now prefer the word "somatization." The size of one's psychic field of vision depends on one's inner freedom. Every passional idea (Wernicke's overvalued idea) limits one's psychic horizon.

EXPERIMENTS AND REPORT OF CASES

The variety of the visual impressions received (relation between object and personality) can also be proved experimentally.

Loebe mentioned that Stratton wore reflector glasses for about a week, which reversed all proportions in space. The ceiling became the floor and right became left. After taking the glasses off he still felt this reversal for some time. One has similar sensations on leaving a ship or getting off a horse. The ground seems to rock, and one must adapt oneself to the new conditions.

Jaensch and Mandowsky [1] carried out interesting experiments proving that visual hallucinations occur in healthy people as well as in those suffering from nervous disorders. Jaensch and Krantz demonstrated how the realm of perception depends on the type of personality. They distinguished between "integrating" people and "disintegrating" ones. The perceptions of the first type are determined by their conceptions.

Sidler [2] observed a case of migraine in which amaurosis lasting from ten minutes to three hours appeared as an aura. The attack could be produced artificially by pressure on the eyeball. Loss of vision and headache resulted. The retina was snow-white in consequence of a spasm of the vessels.

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1. Jaensch, W., and Mandowsky, C.: Die klinische Bedeutung psychischer Labilität bei optischen Wahrnehmungsvorgängen, Med. Welt. **6**:1162 (Aug. 13) 1932.

2. Sidler: Schweiz. med. Wchnschr. **62**:529, 1932.

If one considers that migraine is caused by the repression of a disagreeable idea, as I was able to prove in each case (that is to say, an arbitrarily produced psychic scotoma), one will realize that cases like Sidler's seem to prove the close connection between psychic and organic symptoms. All psychopathic persons suffer from a scotoma; there is something which they do not want to see. In cases of migraine the amaurosis would be due to a somatization of not wanting to see.

An experiment made in the Vienna Psychologic Institute proved important statements made by Stern concerning the reliability of the testimony of witnesses. A scene which had previously been rehearsed was played before an intelligent audience, which was ordered to make an accurate report. The result was amazing. Many had seen and heard things that had not occurred. They had transmitted the world of their own ideas into the scene that was played before them. Scarcely a report was complete, and one cannot be surprised when one considers the different types of people perceiving. The visual person perceives differently than the auditive person. Every one has one sense that is dominating. One may call it the sense of predilection, which dominates one's perceptions. One must also consider the phenomenon of synesthesia. An example of this is the *audition coloré* (colored hearing).

Ruths (psychology of musical phenomena) had various pieces of music played before simple people to get their impressions. A peasant heard the Pastoral Symphony. While it was being played he saw a landscape which corresponded almost completely with the picture Beethoven must have had in mind.

Psychologists and physicians still know too little about the defects of the senses. They have studied color blindness, but they know little about individual differentiations of seeing, smelling, hearing and feeling. Aside from the sense of predilection, a defective sense always exists. The one sense becomes hypertrophied at the expense of the other.

Pfister made analytic experiments on color blindness which prove a certain psychogenesis. I had the following experience with a color-blind man:

I placed various colored books before him and requested him to name the color immediately without examining or meditating before replying. In the first twelve experiments the results were positive. Later he was asked to examine the books more carefully, and made more than 60 per cent mistakes. The first impression was always correct, but owing to the influence of the inner world of thoughts certain colors were rejected. I shall describe more details of this case later.

How far can this inner influence of the sense of perception go? It can go to the extent of complete blindness, the cessation of all perceptions through the eye.

Morton Prince reported a case dealing with this subject, to which I shall refer briefly:

A man, 30 years of age, was brought to the hospital because of acute blindness. The objective findings were absolutely negative. The patient had an ugly wife with whom he lived in an unhappy marriage. He had married her because he was fascinated by her voice. He met a beautiful girl with whom he fell in love, although her voice was unattractive. He was the father of three children and had a good position, but was ready to sacrifice everything for his love. He and the girl resolved to elope. He went to bed early, as the train left early in the morning. After a restless night he awoke, wanted to turn on the light and discovered that he was blind (flight into illness). He had attained several purposes: He was not able to elope, and he could not see his ugly wife but only hear her beautiful voice. He was cured within a few days.

Hartmann [3] reported a case of depersonalization: A man heard unexpectedly that his wife was deceiving him. He tried to visualize her in bed with her sweetheart, but was unable to do so. Later he was unable to visualize anything.

Gutheil [4] described a patient who was brought to the clinic because she complained that she had no eyes. Her ailment began with the failing of her powers of perception. Later the delusion of blindness developed. Before the appearance of the visual disturbance she had compulsions of sexual perversions. She had to combat this impulse for so long that she finally lost the capacity of visualization entirely.

Feldmann [5] described a series of psychogenetic disturbances of vision. A patient with hysterical paralysis of the abducens was cured in one visit. Another patient, a woman, aged 36, would suddenly become blind while walking along the street. Analysis revealed that she did not dare to look at men. She had to have some one accompany her, as she was afraid that she might succumb to the tempting looks of men (self-protection against seduction).

Bien [6] reported a more complicated case:

A 33 year old married woman complained that, when walking along the street, it turned to an angle of 180 degrees. As a child of 2 years she had amused herself with visual impressions so that she saw the room in two directions. At the age of 13 she had had a trauma when horses bolted. She was hospitalized at the age of 15. She married, but her married life was loveless, and she later became anesthetic. She feared to leave the house, as the street might turn around. In the morning she resisted opening her eyes. If she saw the room it seemed to rotate—the transition from dream to reality. On awakening, she imagined that the bed stood in a reversed direction. She preferred to lie with closed eyes in order to orientate herself and establish the normal direction of her imagination. The

3. Hartmann: Ztschr. f. d. ges. Neurol. u. Psychiat. **74:** 1922.
4. Gutheil, E.: Psychoanalyt. Praxis **2:**122, 1932.
5. Feldmann, S.: Psychoanalyt. Praxis **2:**147, 1932; **3:**73, 1933.
6. Bien, E.: Psychologie und Medizin, vol. 4, no. 1.

hallucination in bed first occurred at the age of 17. Three years before, she had had a cataleptic attack during which she was unable to move; she was conscious and wanted to speak but could not. Analysis revealed that she had been in love with a cousin, but owing to a subsequent affair she could not marry him. This pushed her out of the normal course of her existence and forced her life into another direction. There was also an organic foundation. Professor Ruttin's findings were: chronic catarrh in the left ear and a laesio auris internae of the cochlear and vestibular parts. The patient stated that she experienced a distortion of direction whenever the frontal right semicircular canal was irritated.

The disturbance of the organ of equilibrium does not explain the neurotic symptoms.[7] I want to draw attention to the difference between the images which this patient created in her imagination and the impressions which she received from reality. Many neurotic persons suffer from serious defect of the imaginative faculty. Often they require tangible evidence of reality in order to produce the desired image.

A 29 year girl could not visualize her fiancé. She must look at his photograph, but never saw a real image. One day she received an eyelash in a letter, and suddenly the man stood before her mental eye.

Many cases of agoraphobia are based on the fact that the patients interpret the street symbolically in imagination. Some even look constantly away from the street into the heights. An oculist in Breslau observed that patients with this condition suffer from differences in the level of the lines of vision (upward squinting). He prescribed glasses correcting the squinting and was able to relieve some of the patients temporarily.

I was able to cure a patient with strabismus without glasses in a few sittings.

A 28 year American lawyer complained of ocular fatigue and squinting. He wore heavy glasses, but squinted on looking to the right and left. He was also annoyed by stiff collars.

He consulted several analysts about a dream; but did not get a satisfactory interpretation:

"I was accused of murdering my mother. I stood before the tribunal. My lawyers defended me on the ground that I could not have murdered my mother, as she was still alive. An endless discussion ensued whether it was possible that a murdered person can live. I was bored. I was annoyed and left the tribunal."

In association of ideas he stated that since his marriage he had been living in a state of antagonism with his mother. The judge in the dream was a lawyer who had unsuccessfully defended a murderer who was hanged.

In his matrimonial life, he suffered agony from morbid jealousy. He watched his wife and reproached her for flirting. He had married her secretly, without the knowledge of his mother, who never forgave him. During his married life it was difficult for him to suppress his polygamous instincts. He desired to look at the pretty girls in the street, but how could he do something he had forbidden his wife? He tried to look straight ahead, but his eyes wandered to the right and left.

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7. Schilder, P.: The Vestibular Apparatus in Neurosis and Psychosis, J. Nerv. & Ment. Dis. **78**:1 (July) and 137 (Aug.) 1933.

His mother had said, "Your marriage will be my death," and thoughts of murder had entered his mind. He feared that he might commit murder in a jealous rage. Therefore the lawyer appeared in his dream, warning, "That would bring you to the gallows; you would be hanged." Every tight collar brought up some association with hanging. His strabismus was a symptom which allowed him to see what he did not want to see. After a few visits the patient called wearing a stiff collar and no glasses.

The success of this case gave me the reputation in America of being a famous oculist. Numerous persons with myopia and hyperopia called on me, and I had great trouble to make them understand that the admitted success had been positive only because the condition had been a psychic disturbance.

I have helped half a dozen of my patients to get along without glasses. These were mostly women suffering from a psychic scotoma. I do not want to extend this etiology interminably. Often the condition represented a repressed feeling of hatred for the husbands whom they pretended to have married for love; often it represented love for another, which they did not want to admit to themselves. In every case the psychic blindness was somatized by physical inability to see. The symptoms varied. Sometimes the letters danced before their eyes; sometimes a large letter was interchanged for a small one, and sometimes the image became effaced. There was headache, and the eyes burned so that they could not be closed.

It would be wrong to assume that I am trying to find psychogenetic disturbances of vision in each case and that in so doing I overlook organic disturbances.

In a case of double vision the ocular findings were negative at first; later ophthalmoscopic examination revealed a tumor of the brain. Although the patient had been relieved of his headaches in our heart-to-heart talks and insisted on further psychic treatment, I was compelled to discontinue such treatment in view of the new findings.[8]

To terminate this series, I shall cite the case of color blindness previously mentioned. The patient was not able to visualize a person, a picture or a landscape. He dreamt frequently, and his dreams were full of visual images. That shows that in his dreams he was able to visualize thoughts, whereas when awake he was incapable of perceiving any image in his thoughts.

In the course of the analysis his capacity to visualize improved, but when he looked at an illustration of a couple embracing and kissing each other he saw only the lower part of the picture.

It became evident to me that he did not want to see the kiss, and later in the analysis his dreams and free associations disclosed that he

8. Stekel, W.: Vorsicht in der Diagnose einer Parapathie, Psychoanalyt. Praxis **1**:46, 1931.

had observed his mother in an intimate embrace with a stranger. This repressed embarrassing recollection had drawn all other conceptions along with it into the abyss of the unconscious.

I do not want to go further into the details of this case. However, it seems to give convincing proof for my thesis: One sees what one wants to see, and overlooks what one does not want to see.

COMMENT

Every one has complexes, conscious or unconscious, which influence his sphere of interests. Every one has a sense of predilection. In some persons the eye predominates, and in others the nose, ears, taste or feeling predominate. Psychologists now assume eleven senses (Bühler) in the forming of one's perceptions of the world. With this conception one arrives at the strangest synesthesias. It is said that the French poet Jules Romain was able to produce actual visual images in blind people after having made their sense of touch hypersensitive.

Analysis deals with the ego; it endeavors to sever in the patient's soul what is really part of himself from what is alien, the original from what had been added and acquired. Analysis studies the structure of the soul. It is therefore not a view of life. It can influence a person's views only so far as they have become changed by a pathologic disposition from their original form into the expression of something foreign. Analysis corrects the psychic spectacles and opens one's eyes to what one does not want to see.

"Become what thou art" circumscribes and embraces the whole task of analysis and limits the activity of the psychic adviser, who is not the creator of a new life but the discoverer of sunken treasures, the destroyer of poison-breeding miasmas, the proclaimer of the truth, the curer of blindness and the enlarger of one's mental horizon. Therefore, the analytic method was originally called the cathartic, i. e., the cleansing, method. In this sense it is not analytic, because analysis assumes the knowledge of component parts. It is catalytic; it dissects, cleaves, cleanses and creates new combinations, thus bringing about synthesis.

The neurotic person is afraid to give up positions he has occupied which represent the fortifications of his morbid individuality. If psychoanalysis succeeds in convincing him that he must give up the mechanisms of self-protection, that he can risk the conflict with life, that this combat will mean progress and cure for him, and if it opens his eyes to everything he does not want to see, it will have achieved a great task.

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LAMP FOR DETERMINATION AND MEASUREMENT OF THE PREFERRED INTENSITY OF LIGHT FOR READING AND FOR OTHER WORK

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Two important aspects of clear seeing are clearness of imaging and powers of discrimination of the retina. An increase of intensity of light over a suitable range renders important service in relation to both of these functions: 1. By causing a decrease in the size of the pupil it increases the clearness of the image. This effect is especially marked when there are defects in refraction, even in case of small residual defects. 2. By an increase in the sensation difference between the object and the background the retina's power to discriminate details in the image is strongly intensified. Under the higher intensities of light details which would be missed completely under low intensities are discriminated in spite of the blurring of the image. 3. There is also a possible effect on the function of space discrimination, over and above the effect on the discrimination of difference in brightness. It is well known that an increase in the size of the object causes an apparant increase in the intensity of the visual impression. It may well be that there is a reciprocal action, namely, that an increase in the intensity of the image causes an increase in the apparent size. Again, adherents of the "Duplicitäts" or rod and cone theory of vision may find a reason for a finer space discrimination at higher intensities of light because of the preponderance of cones functioning at the higher intensities, the cones being assumed to have a finer space discrimination than the rods. In any event there seems to be no doubt as to the fact that the power of the retina to discriminate detail is greatly increased by an increase in the intensity of light over a wide range.

Knowing this fact, it appears to be the physician's duty to find out what is the best intensity of light for reading and other purposes for the eyes that come under his care and to include this in his prescription or instructions to the patient as well as the kind and strength of correcting lens. As we have pointed out in another article, the refractionist, however careful and skilful he may be, can go only so far in

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determining and procuring proper correcting lenses for errors in refraction. Beyond this, however, a great deal can be done for the patient in finding the intensity of light which gives him the best and most comfortable vision. Even a small change in the size of the pupil due to the increased intensity of light will help a great deal in clearing up a small residual astigmatism and in alleviating the discomfort and annoyance which low astigmatisms frequently cause.

Our interest in this subject, however, centers especially in the care and treatment of the old eye. Unless there is some contraindication, old eyes characteristically require a high intensity of light. The following are some of the reasons why old eyes require more light than young eyes: the inferior imaging power of their refracting mediums, the diminished transparency of the mediums, the reduced size of the pupil, the decay in all their processes of adaptation and adjustment, and the failing powers of the retina itself.

In this connection we have made determinations of the amount of light required by old and young eyes to give the same acuity of vision, and in doing so we have shown that, functionally considered, many years can be taken off the old eye by proper attention to lighting conditions. We have also shown the great effect which an increase in the intensity of light has on the near point of vision in presbyopic and near presbyopic eyes and how greatly it can be made to aid and even to a certain extent substitute for the correcting lens. The higher intensities of light are also of great service in increasing the range of distance over which the presbyopic person can see with his bifocal lenses. This increase is especially needed in cases of advanced presbyopia. In connection with our own work we have always felt that one of the weakest points in the refractionist's technic is his correction for presbyopic eyes. The prescription of the optimum intensity of light will aid materially in compensating for mistakes, errors in judgment and unavoidable errors in the refractive prescription. It is a question whether the refractive correction can ever be put on an entirely satisfactory basis. It is well, therefore, to seek help elsewhere. Presbyopia is by no means a condition in the realm of the refractionist alone. It belongs to that of the physician who takes into account all the factors and conditions which make of the eye an organ of vision.

We have also shown the effect of an increase in the intensity of light on the eye's tolerance of disturbances in coordination of convergence and accommodation, on the speed of vision, on the power to sustain clear seeing and on other important visual functions. Time need not be taken to review that work. It is noted merely to emphasize further how important it is for the oculist to include the subject of illumination in his program of study and to add to his office equipment the devices needed to take advantage of the help it may give.

Two services can be easily rendered by the refractionist along these lines: 1. He can determine the intensity of illumination which will give the patient an acuity satisfactory for all his needs or, if that cannot possibly be obtained, the intensity which gives him the highest feasible acuity. For this purpose a means of illuminating the acuity chart over a wide range of intensities without change in the color of the light is needed. Our acuity lantern which was described several years ago [1] will soon be available in a form which gives a range from 0 to 50 foot-candles at a distance of 6 meters.

2. He can determine the intensity which gives the most comfortable illumination for reading and similar types of work. For this purpose we have devised a floor lamp which gives a range of illumination from 0 to 90 foot-candles on a plane 2 feet (60.96 cm.) distant. In this case the change of intensity is also accomplished without change in the color of the light. This lamp can be used not only for the lighting of the reading page and other horizontal and inclined surfaces, but also for the illumination of test charts and other test fields in the vertical plane.

DESCRIPTION

The unit consists of a housing mounted on a floor stand with an adjustment for height. There is also a swivel adjustment for changing the angle of the housing of the unit with the vertical plane. As indicated, the light can be directed on horizontal, inclined or vertical surfaces. The housing consists of a rectangular enclosure 6 inches (15.24 cm.) wide, 6 inches high and 7½ inches long (19.05 cm.). Flaring out from this to provide for a wider spread of light is an extension 10 inches (64.51 cm.) square at the outer end or opening and 4½ inches (11.43 cm.) deep. The angle of inclination or flare of each of the sides of this extension is 27 degrees. Inside, it is surfaced in a flat white to give a high coefficient of diffuse reflection, excepting a band or rim 1½ inches (3.81 cm.) broad, adjacent to the opening. This rim is surfaced in flat black to reduce the glare from the opening. Just back of the extension and across the opening of the housing described is a means for decreasing the intensity of light. This means provides for a decrease of illumination in continuous series from the full output of the lamp to 0 without change in the color or composition of the light, in the size, shape or position of the illuminated area or in the evenness of the distribution of light within this area. It consists of four vanes which extend across the opening in such relation to each other that when their flat surfaces are parallel to the beam of light the maximum amount of light passes through the opening, and when they are rotated to a

1. Ferree, C. E., and Rand, G.: Lantern and Apparatus for Testing the Light Sense and for Determining Acuity at Low Illuminations, Am. J. Ophth. **3**:335, 1920.

position at right angles to the beam the light changes in continuous series from full intensity to 0. These vanes are made of thin sheet aluminum, no. 23 B & S gage, and are painted flat black on both surfaces. At the central point of each end of the vane is attached a pin or shank which passes through a hole to the outside of the housing. Mounted at the outer end of each of these pins on one side of the unit is a cog-wheel or gearing 1½ inches (3.810 cm.) in diameter. When these cog-wheels are turned through 90 degrees the vanes pass from the position of full light to complete extinction. Meshing with the second cog-wheel is a fifth ⅜ inch (0.952 cm.) in diameter, which may be called the driving or master wheel. Its circumference is thus one-fourth that of the cog-wheels at the end of each of the vanes. Thus when the driving wheel makes one complete turn the vanes turn through 90 degrees and change the intensity of light from full to 0. Mounted above the driving wheel on its axle is a dial of suitable size with a scale graduated in terms of foot-candles of light falling on a plane 2 feet from the opening of the lamp. In order that no shadow shall be cast by the vanes in any position in their rotation, a plate of Belgian flashed opal glass is mounted directly in front of them, between them and the surface to be illuminated. In addition to eliminating completely all shadows on the illuminated surface, this provision secures exceptionally good diffusion of light. The spread of light from the opening has been checked at several distances to make sure that it follows the law of squares. Thus if a rating of the intensity is wanted at a distance greater than 2 feet, it can readily be computed from a reading of the scale. To secure constancy of current an ammeter and rheostat may be used, if desired; also the intensity of the light can at any time be measured with a photometer instead of read from the scale. From the way in which the contiguous vanes are driven, it will be noted that they turn in opposite directions. This insures an absence of shift in the position of the illuminated area and of change in its size or shape. When the vanes all move in the same direction, as is the case in Venetian blinds, all these changes take place. The use of such vanes as we have employed, in combination with a diffusing plate to eliminate shadows, provides a simple mechanical means of varying the intensity of illumination over any range that may be desired and one that is free from the objections as to effects of illumination and inconveniences of use which may be noted in connection with other means of reducing the intensity, such as change of distance of the source, rheostat, etc. If a greater precision of setting the control is wanted than can be obtained with cog-wheels, other means of rotating the contiguous vanes in opposite directions can be employed.[2]

2. Since this was written we have devised a simple means of eliminating the slack or backlash in a series of cog-wheels and of making compensating adjustments for wear.

The source of light used is a round bulb, type G, spot-light service lamp. This type of lamp can be operated efficiently in any position except within 45 degrees of the vertical, base up. Behind it is mounted a concave mirror reflector. This combination of lamp and concave reflector is used in order that a high beam candlepower may be obtained from a small source. Pear-shaped Mazda type C lamps giving an equivalent intensity of light on the diffusion plate would, for example, be much too large for a feasible size of housing, and tubular lamps of the projection type can be operated only base down. We have thus far used lamps of 250 and 400 watts. With the former the range of intensity of light on a plane 2 feet distant is from 0 to 40 foot-candles,

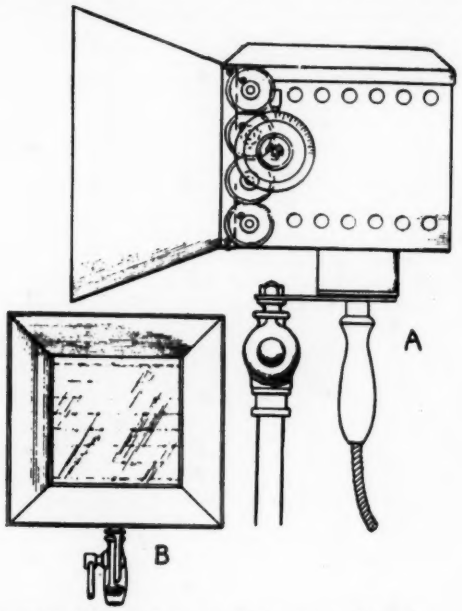

Fig. 1.—Variable illumination lamp; *A* shows a side view; *B*, a front view.

and with the latter, from 0 to 90 foot-candles. We have found these ranges to be fully adequate for the purposes for which the unit is intended.

Diagrams of the unit are given in figures 1 and 2 and photographs in figures 3 and 4. Figure 1 *A* shows a side view of the housing and *B*, the front view. The side view shows the two parts of the housing, the cog-gears, the dial and index for the photometric scale, the light-proof ventilating apertures, the swivel device for mounting and the handle by means of which the housing may be held when detached. The front view shows the diffusing plate in position in front of the rotating vanes and the spread of the opening as seen from the full front position.

Figure 2 shows a diagram of the housing with a glare baffle of the egg-crate or cellular type substituted for the bonnet or outwardly flaring

extension in front of the housing shown in figure 1. A vertical section of the unit (fig. 1, *A*) shows the lamp with the concave mirror reflector behind it, the rotating vanes for varying the intensity with the diffusing member in front of them and the boxing in which the glare baffle is mounted.

A description and discussion of the baffle, shown in figure 2, are given in a previous article.[3] Briefly it consists substantially of two series of partitions extending across the opening of the enclosure at right angles to each other. The partitions extending in each direction are parallel. In the present model they are spaced about 2 inches (5.08 cm.) apart and are approximately 2 inches deep. The greater part of the light is allowed to pass through the passages formed by these partitions to the surface to be illuminated, only such rays being intercepted as would produce glare in the eyes of those working or located in the various

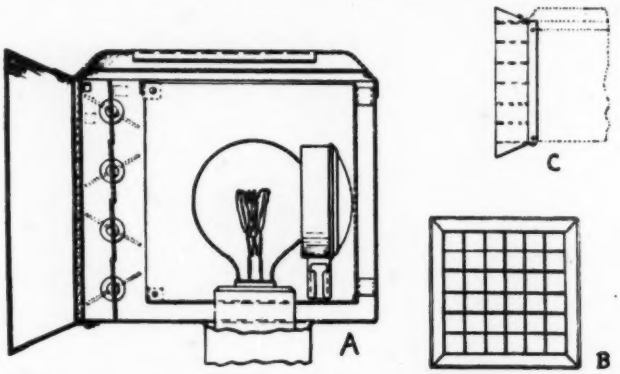

Fig. 2.—Variable illumination lamp with the glare baffle; *A* shows the position of the concave mirror; *B*, a front view of the glare baffle, and *C*, a vertical section of the shallow boxing containing the baffle.

probable positions in the room. No glare is experienced unless one is directly in front of the unit, or nearly so, and looks into the opening. In all the other positions in the room the eye is protected in all directions. In order to give complete protection both surfaces of the partitions are painted flat black. When the light is turned on, the opening, as seen from the various positions in the room with the exception of direct confrontation or nearly so, is either not luminous at all or has a dull luster or a soft silvery sheen of such low brightness as not to cause annoyance or discomfort to the most sensitive eye.

In using the lamp for determining the amount of light needed for reading, the patient is seated directly facing the page with the light passing over his shoulder. The reading page is held or supported at a

3. Ferree, C. E., and Rand, G.: Lighting Without Glare: A Further Contribution, Arch. Ophth. **9**:344 (March) 1933.

distance of 2 feet from the opening of the lamp which is set at the angle for which the scale is calibrated. This angle is read from a scale suitably positioned at the bottom of the housing or is determined by other means. The light is varied until an intensity which is most satisfactory for the patient is found. It does not take long for the patient to decide which is for him the best intensity or small range of intensities, as the case may be. When his judgment is given, the intensity of light on the page is read on the graduated scale provided as noted.

In this connection it may be noted that the amount of light needed varies greatly with different people, with age and with the type of work. Just how much light is needed for this or that person or for this or that type of work cannot be determined in general terms. A special determination has to be made for each person and for each type of work. One can determine in the laboratory, for example, the effect of an increase of intensity on the power of vision, the fact that old and defective eyes need more light than young and healthy eyes, etc., but the amount that is needed for one certain person cannot be determined in general terms or deduced from laboratory generalizations. A satisfactory determination can be made only by an individual test for the person and for the work in question. It is in recognition of this fact that the present unit has been devised.

The unit may be made to serve other useful purposes, some of which are noted here.

USES

1. *In the Office and Laboratory.*—We have found the unit to be useful in the office for giving a standard illumination of the test object in the determination of the near point and for determining the effect of changes of intensity of light on the near point; also for illuminating test charts of the wall type, tangent screens and test surfaces of all kinds. Provided with a double etched plate of artificial daylight glass instead of the diffusing plate of Belgian flashed glass the lamp is an excellent means for illuminating a tangent screen with light of daylight color and of an intensity which is variable through any range that could possibly be wanted. Moreover, the wide spread of well diffused, evenly distributed light makes it especially suitable for the illumination of large tangent screens. In this connection the shadowless character of well diffused light is worthy of consideration.

In the illumination of the test charts, tangent screens and other test surfaces in the vertical plane the unit is installed in a suitable position and at the desired distance from the surface to be illuminated, and the housing is turned into the horizontal plane. As indicated, the spread of light is sufficiently wide to illuminate uniformly an exceptionally large area. In all these connections it should be noted also that when con-

venient portability is not an important element in its use, the unit can be made larger, lamps of higher wattage can be used, and a wider spread of light can be secured through the use of a wider opening. The wider the opening, the more effective is the action of the diffusion plate in the elimination of shadows. The best illumination of a tangent screen can be secured with two units suitably positioned at either side of the patient, or closer to the screen if desired. However, so wide is the spread and so good is the distribution of light that a good effect can be obtained with one unit if the opening is placed near the patient's shoulder. The provision for the reduction of the intensity of illumination without change in the color of the light is, it may be noted, a convenient and valuable means of adding sensitivity to the type of examination that is usually made with the tangent screen.

There has long been a need in laboratory work for a lighting unit with which the illumination of various test surfaces can be varied without change in the composition and color of the light. It is also more convenient if this variation can be made without changing the position of the source. In laboratory practice changes of intensity are usually produced by changing the distance of the source from the plane to be illuminated or by changing the intensity of the operating current by means of a rheostat. Neither of these means is entirely satisfactory. To produce a change in intensity by changing the distance is cumbersome and inconvenient; an undue amount of space is required to make the change; the range of change is limited, and the area over which the illumination spreads varies in most cases as the square of the distance of the source from the plane to be illuminated or nearly so. Also, because of the limitation at the lower end of the scale, the change cannot be made from full intensity to 0 or very low intensity without the use of absorbing mediums. The range in the lower part of the scale is important for many purposes.

The objections to the use of a rheostat are still more serious. The most serious, of course, are the radical changes in the color and composition of the light that are produced if any considerable change of intensity is made. In addition rheostats are expensive to make; there is a heating effect which is in direct relation to the reduction of the intensity of the operating current; the change is usually discontinuous and occurs in rather coarse steps, and the range of change which is feasible is comparatively limited. Even if the objectionable change in the composition of the light is disregarded, the range and continuity of change that are needed entail so much expense and special construction, particularly for lamps of the higher wattages, as to be practically prohibitive. Indeed it may well be said that in connection with the control of intensity of illumination, rheostats can properly be used only to prevent changes of intensity, not to produce them.

The changes in the composition and color of the light, it scarcely need be noted, render the use of a rheostat for a varying intensity of light prohibitive for all work with color. In case of both pigment and filter colors, the hue, brightness and saturation are all affected by the change in composition of light produced by changing the intensity. In the former the total amount of light reflected and in the latter the total amount transmitted are changed; i.e., the coefficients of both reflection and transmission vary with the variation of intensity. Also the ratios of the amounts which are reflected and transmitted in the different parts of the spectrum are changed. This results in a change in composition. Over and above these physical changes are the subjective changes. They can be briefly summarized as due to the selectiveness of the eye's response to both wavelength and intensity of light and to the selectiveness of its combining reactions to wavelength at different intensities. These effects are obvious and so well known among laboratory workers that there is little need to caution against them here. They are not so well known, however, in all the uses of color that are made in the applied fields. Even in laboratory work one still finds in some cases the use of a rheostat to vary the intensity of light corrected as to color by means of a daylight filter.

Perhaps the most frequent and most flagrant misuse of rheostats to vary the intensity of light found at present is in connection with the illumination of charts for the testing of acuity. Test cabinets, provided with a rheostat for varying the intensity of illumination, are being sold in professional, academic and industrial circles. The two chief uses of these cabinets are the rating and grading of eyes as to acuity and the detection and correction of errors in refraction. In relation to the former use it should be obvious that the ratings of eyes made at different intensities of light when the differences are produced by a rheostat are not fairly comparable because of two reasons: One is related to the formation of the image; the other to its discrimination. Among the causal factors for poor imagery are some which are common to all eyes and cannot be corrected; i.e., they are inherent in the imaging and cannot be eliminated. Some of these are: chromatic aberration, the blurring and confusing patterns formed about each point in the image caused by the diffraction of the light near the edge of the pupil and wherever else an opacity or striation is present in the path of the light, and veiling glare due to the scattering of light by the media of the eye. The errors due to all these factors are relatively high for light toward the long wave end of the spectrum and for mixed light of the composition produced by reducing the intensity by means of a rheostat. With respect to the discrimination of the image, relation to background is a factor. The letters of the test chart have a different visibility when seen on a

comparatively white background and on backgrounds which are colored in different amounts by the incident light. The hue, saturation and brightness of the background are all important in the visibility of the black letters; i.e., the sensation difference from the background varies with all these factors.

Still more objectionable is the use of a rheostat in connection with acuity charts for the detection and correction of errors in refraction. Some years ago we [4] demonstrated that sensitivity was added to the detection of errors in refraction by the acuity method by the use of very low intensities of light for the illumination of the test object. The reason for superior sensitivity is not difficult to understand. If the retina is given a high power of discrimination, the details of the test object can be seen even though small amounts of blurring are present. High intensities increase the retina's power of discrimination, and low intensities reduce it. At very low intensities the retina has its minmum power of discriminating detail, and the acuity test therefore, in so far as this factor is effective, its maximum sensitivity as a means of detecting flaws in the imagery. The deeply saturated reddish orange light that is obtained when these favorably low intensities are produced by means of a rheostat causes two deleterious effects: 1. Because of chromatic aberration, the inferior focusing of the excess light at the long wave end of the spectrum and the increase in veiling glare due in part, perhaps, to the greater tendency of the mediums of the eye to scatter the long waves and in part to a greater spreading of the excitation in the retina caused by the long wavelengths, it produces in the image an obscuring unclearness which cannot be corrected and which therefore lessens the sensitivity of the test and makes it more difficult to detect the ametropia. 2. There is danger that a false correction may be given for hyperopia, hyperopic astigmatism, myopia and myopic astigmatism. A shift of the composition of the light toward the red end of the spectrum would, for example, tend to cause an overcorrection of the hyperopias and an undercorrection of the myopias. While small errors may not be of consequence in the sphere correction, they are of decided consequence for the cylinder correction, and these devices for high sensitivity are especially intended and needed for the cylinder correction; that is, while the high astigmatisms produce the greatest amount of unclearness of seeing, it is the low astigmatisms and the small residual uncorrected errors that often cause the greater amount of asthenopia and discomfort. In any event, the examiner cannot afford to introduce a needless source of error into his technic. Further, it is difficult to get

4. Ferree, C. E., and Rand, G.: Visual Acuity at Low Illumination and the Use of the Illumination Scale for the Detection of Small Errors in Refraction, Am. J. Ophth. 3:408, 1920.

a satisfactory reduction by means of a rheostat to the low illuminations that are wanted unless special care is exercised in its planning and construction, more care than is usually given to the planning and construction of a refraction equipment.

2. *As an Examining Lamp in Hospitals and for Local Illumination in the Operating Room.*—For these purposes the unit shown in figure 2 *B* and in figure 3 is preferred. In this unit, as already noted, a glare

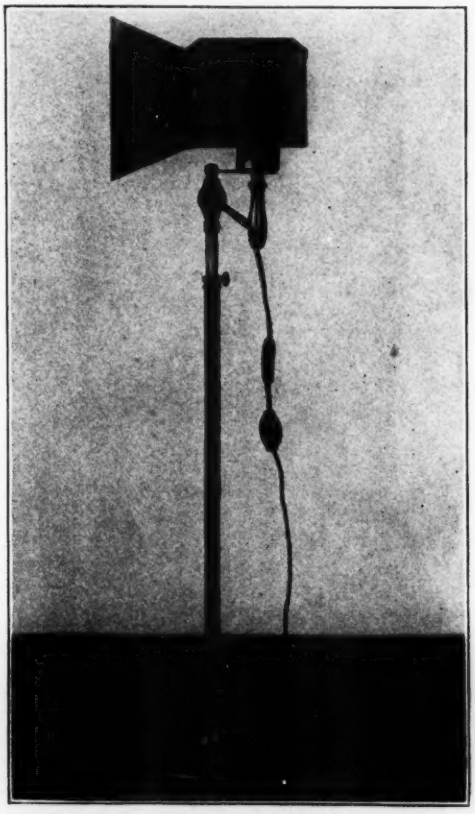

Fig. 3.—Photograph of the variable illumination lamp without the glare baffle.

baffle of the egg-crate or cellular type is substituted for the bonnet or outwardly flaring extension in the front of the housing shown in figure 1. Thus constructed the unit is absolutely glareless, and when mounted on casters or small wheels can be made to render valuable service in hospitals where, in making certain types of examination, an illumination is wanted which may be graded in intensity to suit the needs of the examination and which is entirely glareless to the patient and to the examiner and his assistants. The unit can be wheeled from room to room and used over a table or a bed, and the light can be directed from

below the horizontal almost to the vertical. If light of daylight color is wanted for dermatologic and other types of examination Macbeth artificial daylight glass, heavily etched, may be substituted for the plate of Belgian flashed glass.

Provided with the glare baffle the unit should also have a use for local illumination in the operating room. The following are special features of fitness for this purpose: 1. The illumination given is glare-

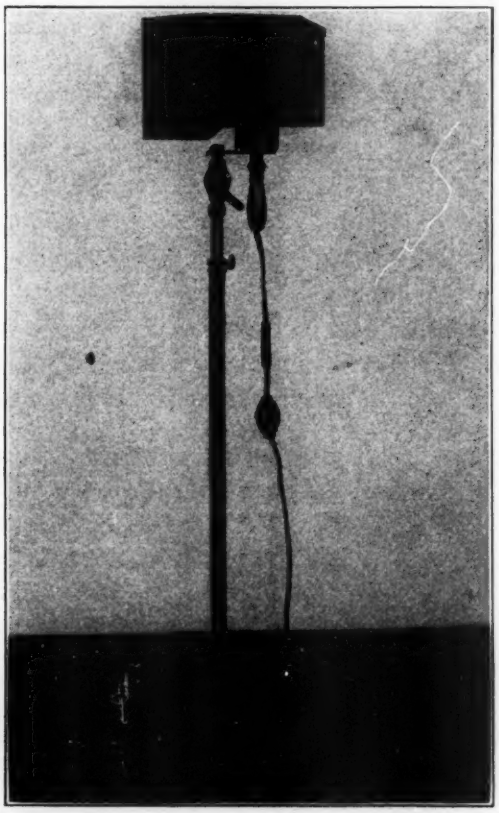

Fig. 4.—Photograph of the variable illumination lamp with the glare baffle.

less and well diffused. In many cases in an operating unit, in order to place the illumination where it is wanted, a directed beam of light is used. Such a light is apt to cause deep shadows which are annoying and troublesome to the operator. Also in a great number of positions in which it has to be placed, the opening in the unit causes troublesome and annoying glare in the eyes of the operator and his assistants. With the unit described, the eyes of the operator and his assistants are completely protected from the glare of the opening and the light may be made to come from any direction that is needed and still be so well

diffused as to eliminate troublesome shadows. In the latter respect, i. e., in the power to eliminate shadows, the illumination obtained is similar to daylight. 2. The intensities provided may be varied in continuous change from 0 to as high intensities as are ever needed without change in the composition and color of the light or in the size, shape or position of the illuminated area. 3. The unit does not produce a spot-light effect as is the case in a directed beam of undiffused light. Instead it gives a wide spread of well diffused, evenly distributed light over the entire field of operation and its surroundings. Daylight color can be provided, as noted, at adequate intensities. When this can be done without sacrificing other valuable features, a great advantage to the operator is secured because the differences which have to be discriminated in the operation are largely differences in color. Differences in color have their full value only under colorless light. If color is present in the light the power of the eye to distinguish between colored objects or surfaces is greatly reduced. Artificial light not corrected as to color is therefore a great and unnecessary visual handicap to the surgeon.

In order to give a convincing demonstration of the effect of the color of light on the color of objects, we have constructed for our laboratory a lighting booth made up of a series of separate compartments. At the bottom of each of these compartments there are eighteen differently colored ribbons mounted on a wooden plate in contiguous horizontal rows, the ribbons being identical in color and alinement from compartment to compartment. At the top of each compartment is a smaller compartment in the bottom of which is a circular aperture of suitable size. In these smaller compartments are installed in order: an electric lamp colored to match the kerosene flame, a Welshbach mantle of the commercial type (99.3 per cent thorium oxide and 0.7 per cent cerium oxide), a carbon lamp, metallized filament, a Mazda type B lamp (vacuum bulb), a Mazda type C lamp (nitrogen-filled bulb), a commercial blue bulb lamp and a Mazda type C lamp, the light of which is filtered through a plate of Macbeth artificial daylight glass. In order that there may be a fair comparison as to color effect, the light falling on the ribbons is made of the same intensity in each compartment by means of suitably positioned neutral filters. The effect on the appearance of the ribbons is striking. Hue, saturation, difference in color and brightness are all affected. The change is so great that it is difficult to believe that the ribbons in the different compartments are all the same. In the artificial daylight compartment they have their full daylight appearance and visibility. In the other compartments, the daylight appearance is lost in proportions varying with the hue and the amount of color in the light, and the difference between the ribbons is masked by an overlay of color due to the light. By means of this demonstration it is not

difficult to convince even the most skeptical surgeon that correction of color should be an important factor in a light used for operating. To be fully appreciated and of maximum service, however, the correction of color should not be secured at the sacrifice of other features which are also of importance in such light.

3. *As an Addition to the Equipment Employed in Lighting Service.*—The unit further satisfies an important and long felt need in lighting service for determining in situ the amount of light needed in any given situation.[5] In order that it may be used in this way, the unit is so made that it can easily be detached from its floor mount and carried from place to place in a small case. It is taken, for example, to the location in question and a trial made to determine the amount of light needed for the type of work that is to be done. For this purpose it is provided with a handle, shown in figures 1 and 2, by means of which it can be held at a distance of 2 feet from the surface of work that is to be illuminated. The amount of light is varied until the worker is satisfied as to the amount that he wants or needs. From this determination it is comparatively easy to plan an installation which will give that amount of light. This procedure is much more simple and much less expensive in time and money than to make one trial installation after another until a decision is reached as to the amount of light required. Usually in such cases an installation is made to deliver a certain amount of light to the plane of work. A trial of its suitability follows, and the amount of light delivered is measured by a photometer or an illuminometer. If the amount is not correct another installation has to be made, the amount measured, and so on until satisfaction is attained. The procedure is long and laborious and in the end often not satisfactory. With the present device the light is delivered and measured by the same instrument, and the entire procedure of determining the amount wanted occupies but a few minutes instead of several days. It is, perhaps, in connection with lighting service and illuminating engineering that the unit has its widest possibilities of usefulness. We have found it extremely useful, however, in all the aforementioned connections which we have had the opportunity to try. The service that it can render presbyopic eyes, for example, is a source of great satisfaction both to the patient and to the examiner. Furthermore, whenever there is an unclear image from any cause, an obstruction or an undue absorption of light

5. To allow for differences in voltage in different locations in lighting service, either a correction factor can be applied to the scale reading or the unit can be operated with ammeter and resistance control. A correction factor can also be used for the angle of incidence on the work in case it is found necessary to vary that angle. For this a suitable swivel and scale can easily be added to the portable mount.

in its passage through the mediums of the eye or any failure in the functional powers of the sensorium not attended by photophobia, the intelligent use of intensity of light is an indicated remedy and in some cases the only importantly effective remedy. The fundamental requirement in lighting, it must be remembered, is that there be enough light. The other aspects of the art and problem of lighting may in comparison be classed as refinements. In this connection it is somewhat interesting to note that the recognition of the importance of studying intensity in relation to the needs of the eye has come later than that for the study of the other factors. Not long ago, for example, we received an inquiry from one of the leading lighting engineers in this country as to whether any work had been done which showed that old eyes really needed more light than young eyes. The recognition of the difference in the age requirement and of the extreme need of old eyes for the higher intensities of light is the most important aspect of the use of intensity of light in the service of the eye, and the provision of a feasible and convenient means for determining just what intensity is needed in each case and of supplying it without glare is the most important of all the problems connected with lighting in relation to the eye.

BLUE SCLEROTICS, FRAGILE BONES AND DEAFNESS

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The purpose of this paper is to call attention to a case of blue sclerotics and fragile bones and to discuss some of the interesting features of this uncommon condition.

Although hereditary idiopathic fragility of the bones was noted as far back as 1788 by Ekman [1] and the occurrence of blue scleorotics was referred to by Henzschel [2] in 1831, Gescheidt [3] in 1832 and von Ammon [4] in 1841, it was not until 1900 that Eddowes [5] called attention to the association of the two conditions, constituting a syndrome, and to the familial nature of the syndrome. Due credit must be given Spurway [6] who four years earlier, in 1896, in publishing a pedigree of hereditary bone fragility running through four generations noted that many members of the family had a curious bluish tinge of the eyeballs.

Deafness was mentioned by Adair-Dighton [7] in 1912 and by Behr [8] in 1913, but credit for definitely including hereditary deafness in the syndrome belongs equally to van der Hoeve and de Kleyn and to Bronson. Van der Hoeve and de Kleyn [9] in 1916 demonstrated before the Groningen Medical Society, the association of deafness with abnormal coloration of the sclera and fragility of the bones, but they did not

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1. Ekman, O. J.: Descriptio et casus aliquot osteomalaciae, Upsaliae, J. Edman, 1788.

2. Henzschel: Ztschr. f. d. Ophth. **1**:52, 1831.

3. Gescheidt: Ztschr. f. d. Ophth. **2**:257, 1832.

4. von Ammon, F. A.: Klinische Darstellungen der angeborenen Krankheiten und Bildungsfahler des menschlichen Auges, Berlin, G. Reimer, 1841, p. 73.

5. Eddowes, A.: Dark Sclerotics and Fragilitas Ossium, Brit. M. J. **2**:222, 1900.

6. Spurway, J.: Hereditary Tendency to Fracture, Brit. M. J. **2**:844, 1896.

7. Adair-Dighton, C. A.: Four Generations of Blue Sclerotics, Ophthalmoscope **10**:188, 1912.

8. Behr, C.: Beitrag zur Aetiologie des Keratokoma, Klin. Monatsbl. f. Augenh. **51**:281, 1913.

9. van der Hoeve, J., and de Kleyn, A.: Blaue Sclera, Knochenbrüchigkeit und Schwerhörigkeit, Arch. f. Ophth. **95**:81 (Jan.) 1918.

publish their findings until 1918. Bronson [10] independently of van der Hoeve and de Kleyn noted this combination of manifestations in 1917.

In spite of the fact that there has been considerable literature on this subject, textbooks of ophthalmology contain remarkably little information. What information there is is misleading. Ball [11] and de Schweinitz [12] associated the condition with inherited syphilis, and the latter stated that the disease occurs only through affected mothers. Fuchs [13] merely mentioned the condition in passing. In the "Kurzes Handbuch der Ophthalmologie," [14] however, there is a comprehensive though short discussion of the subject.

In 1926 Bell [15] collected and published seventy-five pedigrees, which included 489 cases of the disease. Some of the pedigrees extended through four and five generations. Since then about seventy-five reports of isolated cases or of several cases in one family have appeared in the literature, and undoubtedly many other cases have escaped publication.

BLUENESS OF THE SCLERA

The most striking clinical manifestation of the condition is the blueness of the sclera. The color varies in intensity and has been described as pale blue, porcelain blue, slaty blue and even blue-black. The color usually extends from the limbus to beyond the equator of the globe, with a band of deeper tint corresponding to the ciliary body. Sometimes, however, the blue color appears only in spots; in a case studied histologically by Hay,[16] the spots corresponded to unusually thin areas in the sclera. The blueness is always present at birth and remains practically unchanged throughout life.

The exact nature of the change in the sclera has been a source of much dispute. Although Borel [17] suggested that the blueness is due

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10. Bronson, E.: On Fragilitas Ossium and Its Association with Blue Sclerotics and Otosclerosis, Edinburgh M. J. **18**:240 (April) 1917.

11. Ball, J. M.: Modern Ophthalmology, ed. 5, Philadelphia, F. A. Davis Company, 1926, vol. 1, p. 531.

12. de Schweinitz, George E.: Disease of the Eye, ed. 10, Philadelphia, W. B. Saunders Company, 1924, p. 333.

13. Fuchs, E.: Diseases of the Eye, tenth English edition, translated by E. V. L. Brown, Philadelphia, J. B. Lippincott Company, 1933, p. 247.

14. Schieck, F., and Bruckner, A.: Kurzes Handbuch der Ophthalmologie, Berlin, Julius Springer, 1931, vol. 4.

15. Bell, J.: Blue Sclerotics and Fragility of Bone, in Pearson, Karl: Treasury of Human Inheritance, Cambridge, England, University Press, 1928, vol. 2, pt. 3.

16. Hay, P. J.: A Congenital Anomaly of the Sclera: "Pseudo-Coloboma," Ophthalmoscope **5**:300, 1907.

17. Borel, quoted by Terrien, F.; Sainton, P., and Veil, P.: Bull. Soc. d'opht. de Paris **39**:58 (Feb.) 1927.

to cyanosis of the conjunctiva and sclera because of a diminished number of capillaries, it is more generally agreed that the blueness is not scleral but that it is choroidal pigmentation which is seen through a more than usually transparent sclera.

Whether the change in the sclera is merely a quantitative one resulting in abnormal thinness or whether it is a qualitative one resulting in increased translucency has not been decided. Only two cases in addition to Hay's have been studied histologically, and in these exactly opposite conditions were observed. In Buchanan's case [18] the cornea was three-fifths and the sclera was one-third the normal thickness. There was a decrease in the number but no change in the size of the scleral fibers. On the other hand, in Bronson's case the sclera was of normal thickness, and the size and number of the fibers were normal. Conlon and Fridenberg, who examined Herrman's [19] patient, thought that the assumption of thinning of the sclerotic as a cause of increased transmission of color was disproved by the absence of any record of the presence of distention of the globe as in infantile glaucoma or hydrophthalmos; moreover, there was no mention of the presence of coloboma or posterior staphyloma. They suggested that the blueness is due to a transparency dependent on the absence of lime salts in the connective tissue elements of the sclera. In reply to this, Bronson suggested that a quantitative analysis of a blue sclerotic be made when opportunity occurred and that the results be compared with the findings in the normal sclerotic.

Blue sclera may be noted in other conditions, such as congenital buphthalmos, anemia, tuberculosis and certain forms of heart disease, but the differential diagnosis should not be difficult.

FRAGILITY OF THE BONES

The most serious clinical feature of the disease is the liability to fracture from inadequate cause. About 60 per cent of persons with blue scleras have an associated liability to fracture. As a rule, the first fracture is sustained at the time the child is beginning to walk, although fractures may be present at birth or, on the other hand, may make their appearance as late as adult life. A slight fall, a twist or even kneeling may be sufficient to produce a fracture. The bones of the lower extremities seem to be most often involved. Commonly there is no, or only slight, pain because of the minimal damage to the surrounding tissues. Usually healing is rapid. It is not uncommon to

18. Buchanan, L.: Case of Congenital Maldevelopment of Cornea and Sclerotic, Tr. Ophth. Soc. U. Kingdom **23**:267, 1903.

19. Herrman, C.: Blue Sclerotics Associated with Brittle Bones, Am. J. Dis. Child. **9**:205 (March) 1915.

obtain a history of a dozen or more fractures occurring in one person in the course of a few years. The slightness of pain and the rapidity of healing minimize the seriousness of the condition in the mind of the patient and of his friends, leading to marked deformity from lack of proper treatment. Fractures occur most frequently during childhood, and their incidence tends to diminish after puberty. To a large extent this is probably due to the more active physical life that the child leads.

Roentgen studies usually reveal a disproportion in the size of the epiphyses as compared with the diaphysis of a long bone. The epiphyses are normal, thus differentiating the condition from rickets. The diaphysis is slender and usually very irregular. The cortex is thin. There is a general decrease in density of the bones, and they have a fibrous appearance. Usually there are marked deformities.

Key [20] has reported the most complete study of the pathologic changes in the bones: On gross examination the bone was very hard and brittle. The periosteum was friable. The cortex was unusually thick and very hard. (Most other writers have found thinness of the cortex a constant feature.) On staining, the cortex resembled embryonic bone, in which there were a great number of wide canals running parallel to the long axis of the bone and communicating freely with one another. In the dense bone between the larger canals a few typical haversian canals were seen. In some areas there were dense masses of bone in which no canals were seen. The large canals were filled with a very vascular tissue. In most places the large canals were lined with one or more layers of osteoblasts, resembling the osteoblasts of normal bone but present in greater number. The haversian canals were not lined with osteoblasts. A few osteoclasts were seen. The structure of the matrix of the bone was similar to that of normal bone except for the irregular arrangement of the lamellae. The organic matrix, like that of normal bone, was made up of alternating sheets of coarse, collagenous fibers. An occasional elastic fiber was found. Bone cells were about as numerous as in normal cortical bone.

Cases of blue sclera have been reported in connection with various types of disease of the bones, such as osteogenesis imperfecta, periosteal dysplasia, fetal rickets, fragilitas ossium, brittle bones and even marble bones. However, analysis of these cases indicates that the majority actually belong in the group first clearly defined by Lobstein [21] in 1825 under the name osteopsathyrosis idiopathica. This type of

20. Key, J. A.: Brittle Bones and Blue Sclera, Hereditary Hypoplasia of the Mesenchyme, Arch. Surg. **13**:523 (Oct.) 1926.

21. Lobstein, J. G. C. F. M.: Traité d'anatomie pathologique, Paris, F. G. Levrault, 1833, vol. 2, p. 204.

osseous fragility tends to be hereditary. However, authentic cases of blue sclera with osteogenesis imperfecta have been described. These patients present multiple fractures at birth or in infancy. Most of them die in infancy. Whether there is a relationship between these two types of bone disease is not clear, but it seems that they are two different aspects of the same disease. Key pointed out that osteogenesis imperfecta is not known to be hereditary and that the typical patient is born of apparently normal parents and dies in infancy and so cannot transmit the condition. Goin [22] modified this by stating that only that form of the disease occurring without blue sclera is nonhereditary. That both forms may occur in the same family was illustrated by Tillaye,[23] who described a family of five children, all with fragility of the bones, in whom the first fracture noted occurred at the age of 29 years, 20 years, 2 months, 6 weeks and 8 days, respectively. Lovett and Nichols [24] noted the occurrence of osteopsathyrosis in the parent and osteogenesis imperfecta in the child. Looser [25] regarded osteogenesis imperfecta as the prenatal form of the disease and suggested the substitution of the term "osteogenesis imperfecta tarda" for the form which occurs postnatally. Bauer,[26] having described similar pathologic changes in the two conditions, expressed the belief that they are identical.

DEAFNESS

Deafness, the third feature of this syndrome, manifests itself most frequently after the age of 20. In spite of the lateness of the onset and the fact that until rather recently this condition was not observed in association with blue sclera, approximately 60 per cent of the adults with blue sclera suffer from deafness. This has been generally attributed to otosclerosis, occasionally complicated by labyrinthine disease and nerve deafness. Roentgenographic studies of the skulls of the families reported on by van der Hoeve and de Kleyn revealed that the petrous bone cast a dense shadow and that there was a compact opaque mass covering and obscuring the entire vestibular region. From these findings they made a clinical diagnosis of sclerosis and abnormal calcifi-

22. Goin, L. S.: Idiopathic Osteopsathyrosis, Am. J. Cancer **17**:668 (March) 1933.

23. Tillaye, quoted by Sorrentino, C.: Pediatria **39**:625, 1931.

24. Lovett, R., and Nichols, E.: Brit. M. J. **2**:915, 1906.

25. Looser, E.: Zur Kenntnis der Osteogenesis imperfecta congenita und tarda, Mitt. a. d. Grenzgeb. d. Med. u. Chir. **15**:161, 1906.

26. Bauer, K. H.: Ueber Identität und Wesen der sogenannten Osteopsathyrosis idiopathica und Osteogenesis imperfecta, Deutsche Ztschr. f. Chir. **160**: 289, 1920; Ueber Osteogenesis imperfecta, zugleich ein Beitrag zur Frage einer allgemeinen Erkrankung sämtlicher Stützgewebe, ibid. **154**:166, 1920.

cation of the labyrinthine system. Ruttin [27] confirmed the presence of otosclerosis by histologic examination of the petrous bone. However, Friedberg [28] expressed the belief that deafness may be due to labyrinthine disease alone. He described a parent and child with blue scleras and fragile bones. The parent had otosclerosis; the child, labyrinthine disease. Voorhoeve [29] described four cases with labyrinthine disease. Ruttin described three with labyrinthine disease and three with otosclerosis. Apert,[30] on the other hand, regarded the deafness as due to abnormal thinness of the tympanic membrane and laxity of the ligaments attached to the ossicles.

HEREDITY

Heredity is a prominent feature of this disease. Analysis of Bell's statistics indicates that 55.4 per cent of the patients are females. However, the condition may be transmitted by either males or females, the tendency being slightly greater in the latter. The characteristic feature of the heredity is that the condition is transmitted only by affected parents to their children. A generation is never skipped as is the case in hemophilia (knight's move of Bateson). From time to time reports have appeared in the literature of isolated cases occurring sporadically in families in which there have been no similar cases (Bronson, Hein,[31] Bowcock [32] and others).

Examination of the pedigrees reveals the fact that the dominant hereditary characteristic is the scleral anomaly. Without this the characteristic fragility of the bones and deafness do not occur in these pedigrees, although both conditions do occur independently in a hereditary form without blue sclerotics. It is of great importance that patients with this anomaly be warned that if they marry and have children at least 50 per cent of the children will be afflicted.

Embryotoxon, defective development of the teeth and laxity of the ligaments with hypermotility of the joints are frequently reported in

27. Ruttin, E.: Osteopsathyrose und Otosklerose, Ztschr. f. Hals-, Nasen- u. Ohrenh. **3**:263, 1922.

28. Friedberg, C. K.: Zur Kenntnis des vererbbaren Syndroms: Abnorme Knochenbrüchigkeit, blaue Skleren und Schwerhörigkeit, Klin. Wchnschr. **10**:830, 1931.

29. Voorhoeve, N.: Blue Sclerotics in Connection with Other Hereditary or Congenital Abnormalities, Lancet **2**:740, 1918.

30. Apert, E.: Les hommes de verre. Fragilité osseuse hérédofamiliale avec crâne à rebord, sclérotiques bleues et troubles auditifs, Presse méd. **36**:805, 1928.

31. Hein, B. J.: J. Bone & Joint Surg. **10**:243 (April) 1928.

32. Bowcock, H. M., and Lewis, G. T.: Brittle Bones and Blue Sclera; Report of Case with Glycosuria, Ann. Int. Med. **3**:700 (Jan.) 1930.

association with the syndrome. Syndactylism, congenital heart disease and vasomotor defects of various kinds have also been reported but less frequently.

REPORT OF A CASE

E. Z., a 7 year old white girl, was first seen in the Wilmer Ophthalmological Institute dispensary on March 2, 1933, complaining of double vision and redness of the left eye for the past two weeks. A diagnosis of kerato-iritis and blue sclerotics was made, and the patient was admitted to the Harriett Lane Home, Johns Hopkins Hospital, for treatment and study. There was no history of blue scleras or of fragile bones in the family. The paternal grandfather was "hard of hearing" during his old age. Two aunts had epilepsy. The parents were normal. There was no consanguinity. There was one other child in the family, a girl aged 13, who was normal.

The past history was extremely interesting. The child was born at term and weighed 8½ pounds (3,855.54 Gm.). Two weeks after birth the mother noticed that the scleras were very blue, but she paid no more attention to them. The patient developed normally; teeth appeared at 7 months; she talked at 18 months and walked at 2 years. At the age of 2½ years she sustained her first fracture, which occurred in the left femur as the result of a fall in the house. This healed in six weeks. At the age of 4 years, while stooping to pick up something from the floor she complained of pain in her left knee. She had fractured the left femur again. At the age of 6 she fell and twisted her right knee, tearing a ligament.

At 15 months, she was given cod liver oil. When she was 3 years old, viosterol was substituted, and she had taken this preparation almost daily ever since.

General physical examination on admission revealed a fairly well nourished white girl of 7 years. The head and ears were normal, and the hearing was good. A few of the upper molars were carious. There was a deep groove in the lower part of the sternum. The abdomen was distended. There were third degree pes planus and moderate kyphosis, and the length of the lower extremities was disproportionately great as compared to the length of the trunk. Neurologic examination gave negative results.

The blood count showed: hemoglobin, 80 per cent; red cells, 4,250,000, and white cells, 6,000, with 62 per cent polymorphonuclears, 35 per cent lymphocytes and 3 per cent monocytes. A blood smear was normal. The blood calcium was 10.2 mg. per hundred cubic centimeters, and the blood phosphorus, 5.8 mg. The Wassermann test of the blood was negative. The urine was normal.

Roentgen examination revealed that the bones were very osteoporotic and that the cortices were of normal thickness.

Examination of the eyes showed: The right eye was prominent, and the cornea was large, measuring 13 mm. in both the vertical and the horizontal axis. There was a well defined embryotoxon near the limbus above. The sclera had a distinct slaty-blue color extending from the limbus to beyond the equator, with an accentuation of the color corresponding to the ciliary body. The intra-ocular tension and the pupillary reactions were normal. The fundus was normal except for some blurring due to astigmatism. Under atropine cycloplegia the vision could not be improved beyond 20/40 with + 4.50 cylinder at 100 degrees.

The left eye also appeared prominent, and the corneal measurements were identical with those in the right eye. The cornea was slightly cone-shaped. An

Artist's sketch of right eye, showing blueness of the sclera.

UNIV OF MICH

embryotoxon almost completely encircled the cornea. The central portion was markedly hazy and under the slit lamp had a diffuse ground-glass appearance. No vessels were seen, nor were any precipitates present on the endothelial surface. There was a zone of ciliary injection around the limbus, but this was not enough to mask the blueness of the sclera. The pupil was dilated widely with atropine. The eyeball was very soft. A hazy red reflex was obtained from the fundus with the ophthalmoscope. Vision was 2/200 and could not be improved. With the Hertel exophthalmometer, measurements of 20 mm. in the right eye and 22 mm. in the left were obtained.

Aside from the carious teeth, no focus of infection was found. The tuberculin test was negative. Under treatment with atropine and hot compresses, the kerato-iritis rapidly abated. The patient was discharged on March 25, 1933. She reported to the dispensary in April and again in May, the vision in the left eye being recorded as 15/200 on both occasions.

The patient was not seen again until October 18, when she returned in response to a letter. The reason for her long absence was a fracture of the right femur, occurring on June 5, when she twisted her ankle and fell while at play. She was taken to a local hospital, and the leg was placed in a cast for six weeks. At the end of this time, it was necessary to rebreak and reset the fragments, which required keeping the leg in a cast for six more weeks. Since leaving the hospital she had not been able to stand or walk unassisted. She had had no more trouble with her eyes, except that the vision of the left eye had become worse.

Examination revealed no change in the right eye. The left eye was free from inflammation, but there was a dense ring-shaped opacity occupying the temporal two thirds of the cornea. The pupil reacted normally. The tension was subnormal. Through the nasal portion of the cornea a red reflex was obtainable. Vision was 1/200 (eccentrically). The cornea of the left eye appeared definitely cone-shaped. No change was recorded with the exophthalmometer.

COMMENT

The unusual features of this case were the absence of any familial history of blue sclerotics, the presence of kerato-iritis and keratoconus in the left eye and the slight but definite megalocornea without glaucoma in both eyes. No case of kerato-iritis or of megalocornea associated with blue sclera has appeared in the literature to my knowledge. Behr and Sobhy Bey [33] reported the presence of conical cornea. The occurrence of a single case of kerato-iritis, apparently nonspecific, could hardly be considered as being etiologically related to the anomaly. The presence of keratoconus in the same eye was undoubtedly the result of the inability of an already weakened cornea to withstand an inflammatory assault, although the high astigmatic error in the right eye makes one suspect a similar development there. The occurrence of megalocornea without glaucoma is a developmental anomaly pointing to a weakness of the outer coats of the globe and indicates that the assumption of thinning of the sclera is correct.

33. Sobhy Bey, M. A., and Attiak, H.: Bull. Ophth. Soc. Egypt. **24**:67 (Jan.) 1931.

THEORIES

Many theories have been proposed as to the etiology of this condition. Bauer, Key and others have expressed the belief that the condition is due to hereditary hypoplasia of the mesenchyme, pointing out that all the abnormalities are due to defects in the development of some of the tissues which arise from the mesenchyme. Friedberg, also Shugrue and his associates [34] pointed out that this theory does not explain why other tissues of mesenchymal origin, such as the heart, blood and lymph vessels, bone marrow and lymph glands, are not usually affected. Moreover, abnormalities have been found in tissues other than those of mesodermal origin. Blevgad and Haxthausen [35] reported zonular cataract. In some cases there has been syndactylism. Fahr [36] found excessive development of the thyroid and thymus (derived from the entoderm) and of the pituitary and suprarenal medulla (derived from the ectoderm), but this was in one unconfirmed case.

Mayer [37] reported the case of a woman with blue scleras and fragile bones who was operated on for an abdominal tumor. During the operation the surgeon noted an abnormal lacerability of the veins and of the muscular coat of the stomach and intestines. At autopsy there was a narrowing of the ureters and of the blood vessels as well as gaps in the rectus muscles of the abdomen.

All of the endocrine glands have been suspected by one or another author. Lesné, Hutinel and Dreyfus-Sée [38] noted alterations of the thyroid. Gutzeit [39] suspected the hypophysis, and Schwarz,[40] the thymus. Others, particularly Fonseca [41] and Takahashi,[42] have stated that the condition is due to hypoparathyroidism. It occurred to me as remarkable that hyperparathyroidism should have escaped suspicion, since a rather strong case can be presented for this condition.

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34. Shugrue, J. J.; Rockwood, R., and Anderson, E. W.: Fragilitas Ossium and Deafness, Arch. Int. Med. **39**:98 (Jan.) 1927.

35. Blevgad, O., and Haxthausen, H.: Blue Sclerotics and Brittle Bones, with Macular Atrophy of the Skin and Zonular Cataract, Brit. M. J. **2**:1071, 1921.

36. Fahr, T.: Ueber Osteogenesis imperfecta, Virchows Arch. f. path. Anat. **261**:732, 1926.

37. Mayer, O.: Pathology of Otosclerosis, J. Laryng. & Otol. **43**:848 (Dec.) 1928.

38. Lesné, Hutinel and Dreyfus-Sée: Maladie de Lobstien chez un nourrisson, Bull. Soc. de pédiat. de Paris **27**:377 (July) 1929.

39. Gutzeit, R.: Ueber blaue Sklera und Knochenbrüchigkeit, Klin. Monatsbl. f. Augenh. **68**:771, 1922.

40. Schwarz, F.: Beitrag zur idiothischen Osteopsathyrose, Med. Klin. **21**: 1846, 1926.

41. Fonseca, A.: Funccoes parathyroidianos no syndrome das escleroticas azues, Rev. oto-neuro-oftal. **5**:302 (July) 1930.

42. Takahashi, T.: Beitrag zur Kenntnis der blauen Sclera, Arch. f. Ophth. **115**:206, 1925.

In the present limited knowledge of parathyroid physiology at least two clinical conditions are realized to be due to parathyroid dysfunction. The first is postoperative tetany, which is characterized by lowering of the blood calcium and hyperirritability of the voluntary musculature of the body. The second is osteitis fibrosa cystica (Recklinghausen's disease), which is characterized by elevation of the blood calcium, increased excretion of calcium and phosphorus in the urine and feces and marked decalcification of the bones, frequently with the formation of giant cell tumors and cysts. The first condition is easily controlled by administration of parathormone and calcium. The second responds most favorably to parathyroidectomy. Engelbach,[43] who recently wrote a voluminous treatise on endocrinology, stated that hyperparathyroidism is associated with osteoporosis of various degrees. Of fifteen cases reported by him, osteoporosis and decalcification were present in fourteen, in only eight of which there were cysts of the bone. Moreover, otosclerosis is known to appear simultaneously with osteitis fibrosa, and Weber [44] stressed the similarity between the histologic pictures of these conditions. Furthermore, two cases of osteogenesis imperfecta have been recorded which showed enlargement of the parathyroid glands.[45]

The blood calcium and phosphorus in cases of blue sclerotics and fragile bones have usually been normal. Takahashi reported a case in which the blood calcium was found to average from 5 to 6 mg. per hundred cubic centimeters. However, reports of hypercalcemia have been more frequent (Hugues and his associates,[46] Moller,[47] Bowcock, Key and Paal [48]). As Aub [49] pointed out, disease of the bone can and does occur in spite of a normal content of calcium and phosphorus in the blood. It is therefore more accurate to determine the calcium and

43. Engelbach, W.: Endocrine Medicine, Springfield, Ill., Charles C. Thomas, Publisher, 1932, vol. 3.

44. Weber, M.: Otosclerosis in Its Histogenic Relations to Osteodystrophia Fibrosa, Arch. Otolaryng. **2**:1 (Jan.) 1930.

45. The 7 month fetus described by Bauer [26] had four enlarged parathyroid glands, the largest the size of the adult gland (3 mm. in diameter). Histologically these showed hyperplasia. He mentioned that Dietrich (Deutsche Ztschr. f. Chir. **160**:304, 1920) described another case.

46. Hugues, M.; Cazejust, P.; Viallefont, H., and Ratié, A.: Un cas de syndrome de Van der Hoeve, Rev. d'oto-neuro-opht. **10**:693 (Nov.) 1932.

47. Moller, E.: Family Tree of Patient with Eddowes Syndrome, Acta med. Scandinav. **67**:223, 1928.

48. Paal, H.: Ueber blaue Sclеren, Klin. Wchnschr. **8**:1304 (July 9) 1929.

49. Aub. J. C.; Bright, E., and Forman, J.: Am. J. Physiol. **61**:326, 1922. Aub, J. C.; Fairhall, L. T., and Minot, A. S.: Lead Poisoning with Chapter on Prevalence of Industrial Lead Poisoning in United States, by Alice Hamilton, Medical Monographs, no. 7, Baltimore, Williams & Wilkins Company, 1925.

phosphorus balance when studying changes in the metabolism of bone than to record the values for blood calcium and phosphorus, which are remarkably stable. Bowcock and Stevenson [50] reported cases of blue sclerotics in which there was a negative calcium balance.

One of the criteria in the diagnosis of active or latent tetany is the hyperirritability of the voluntary muscles, which may be elicited by electrical or mechanical stimuli (as in Erb's, Trousseau's, Chvostek's and Sternberg's phenomena). Yet in the cases of blue sclerotics and fragile bones in which these reactions were sought they were consistently absent, and even Takahashi failed to demonstrate them in his case of hypocalcemia. On the other hand, many cases have presented hypermotility of the joints and laxity of the ligaments. Moreover, Ottley [51] pointed out that Larat, Bolton and others had demonstrated diminution in the electrical response of the muscles. The response to faradic stimulation is weak, and with the galvanic current there is a greatly diminished response, and the rapidity of both contraction and relaxation is much below normal.

TREATMENT

Drugs, chemotherapy, vitamins, diet, irradiation and endocrine preparations have been tried, but no form of treatment is known to have any effect on this condition. Wilder [52] recommended surgical exploration for tumors of the parathyroid glands in cases of skeletal decalcification of obscure cause, particularly if the decalcification is associated with hypercalcemia. That such a radical procedure is not necessary was convincingly demonstrated by Merritt,[53] who recently reported a series of cases in which hyperparathyroidism was successfully treated by decreasing the activity of the parathyroids by means of roentgen irradiation of the cervical region. No damage to other structures in the neck occurred. In a personal communication to me, Merritt wrote that he knew of one case of the nonhereditary type of fragility of the bones in which roentgen treatments were given over the parathyroids with striking results.

Unfortunately, it has not been possible to bring my patient to the hospital for roentgen treatment. However, when the opportunity arises, this clinical test will be applied, and it may be the final deciding factor in establishing the cause of this condition.

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50. Stevenson, G. H., and Cuthbertson, D. P.: Blue Sclerotics and Associated Defects, Lancet **2**:782, 1931.

51. Ottley, C. M.: Osteopsathyrosis, Arch. Dis. Childhood **7**:137 (June) 1932.

52. Wilder, R. M.: Hyperparathyroidism: Tumor of the Parathyroid Glands Associated with Osteitis Fibrosa, Endocrinology **13**:231, 1929.

53. Merritt, E. A.: Hyperparathyroidism, M. Ann. District of Columbia **2**:247 (Nov.) 1933.

SUMMARY

The development of the knowledge of the syndrome of blue sclerotics, fragile bones and deafness is briefly reviewed.

The clinical features of the condition are discussed.

A case is reported which presented kerato-iritis, megalocornea and keratoconus.

The various theories as to the etiology of the disease are reviewed, and the strong possibility that hyperparathyroidism may be the cause is pointed out.

A method of treatment by roentgen irradiation of the cervical region is suggested.

BILATERAL CAVERNOUS SINUS THROMBOPHLEBITIS WITHOUT INVOLVEMENT OF THE OPHTHALMIC VEIN

REPORT OF A CASE

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Cavernous sinus thrombophlebitis presents typically the triad of ophthalmoplegia, exophthalmos and chemosis, progressing rather rapidly with sepsis to early death, regardless of treatment. Such acute infections usually originate in the venous zone which communicates with the ophthalmic vein, and the thrombosis is retrograde into the cavernous sinus of one side. Infections which originate more posteriorly from the ear or base of the sphenoid do not involve the ophthalmic vein primarily, and may not involve it at all, as in the case reported. These infections are more likely to be low grade. They may be late complications of otitis media or sphenoid sinusitis and may enter the cavernous sinus by way of the petrosal sinuses or the posterior basal sinuses. There is greater opportunity for the formation of a protective thrombus, and there may be absence of diagnostic symptoms and even spontaneous cure.

The occurrence of such atypical cases is probably not fully appreciated by ophthalmologists and the medical profession in general. Eagleton,[1] in his book on cavernous sinus thrombophlebitis, called particular attention to the chronic type of the disease and emphasized that slow obliteration of the sinus from behind may occur without localizing symptoms. He reported eight chronic compensatory cases of this nature —32 per cent of his series. Benedict[2] more recently stated that the absence of ocular signs does not rule out cavernous sinus thrombosis. The frequency of origin from sphenoid osteomyelitis was noted by Smith[3] and Horton,[4] particularly secondary to tonsillar or dental infection.

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1. Eagleton, W. P.: Cavernous Sinus Thrombophlebitis and Allied Septic and Traumatic Lesions of the Basal Venous Sinuses, New York, The Macmillan Company, 1926.
2. Benedict, W. L.: Cranial Sinus Thrombosis: Ophthalmological Aspects, Surg., Gynec. & Obst. **52**:464, 1931.
3. Smith, D.: Cavernous Sinus Thrombosis, with Report of Five Cases, Arch. Ophth. **47**:482 (Sept.) 1918.
4. Horton, K.: Thrombosis of the Cavernous Sinus, Norsk mag. f. lægevidensk. **72**:559, 1921.

Several writers have called attention to a 7 per cent incidence of recovery in the reported cases of cavernous sinus thrombophlebitis (Weizenhoffer,[5] Lewis[6] and Dwight[7]). This figure would probably be greater if the unrecognized atypical cases could be included. Eagleton reported recovery in 19 per cent of 32 cases, based on both a more discerning diagnosis and operative intervention in selected cases.[8]

The case described in this article is deemed worthy of report on account of the chronic, atypical course and the unusual pathologic changes. The case was followed clinically, and the diagnosis was confirmed at necropsy. Pain developed in the right temporal region three days after the extraction of teeth, without fever or evidence of infection. Diplopia in both eyes and ophthalmoplegia of the right eye appeared three weeks later; there were no other signs. There was no fever until six weeks after the onset of the pain in the temporal region; then there was only low grade fever for a week, until signs of meningeal irritation appeared. Block of the right jugular vein was demonstrated, but all the symptoms gradually subsided during the following month, and recovery seemed probable. Recurrent symptoms appeared three months after the onset, with delirium, intracranial pressure and some atypical signs indicating cerebral involvement on the left. Death occurred two weeks later, without characteristic signs of cavernous sinus thrombophlebitis in either eye or evidence of suppurative meningitis. Necropsy revealed cavernous sinus thrombophlebitis, healed on the right and purulent on the left, with a meningeal abscess in the left temporal region. The primary focus of infection was found to be osteomyelitis of the base of the sphenoid bone.

REPORT OF CASE

Mrs. M. O., aged 27, was admitted to the Mercy Hospital, Council Bluffs, Iowa, because of an infection which had developed following the extraction of teeth. The patient had one child.

History.—The family history was irrelevant. The patient's birth and development had been normal. She had had the usual diseases of childhood. There had been frequent attacks of tonsillitis. (The tonsils had not been removed.) Menstruation began at the age of 14 and was regular. Following puberty, there was a marked increase in weight. The weight of the patient at the time of admission was 210 pounds (95.3 Kg.), not a family characteristic. The patient had always

5. Weizenhoffer, A.: Contralateral Cavernous Sinus Thrombosis Following Furuncle of External Auditory Canal, New York State J. Med. **32**:139, 1932.

6. Lewis, E. R.: Cavernous Sinus Thrombosis; Recovery, Ann. Otol., Rhin. & Laryng. **40**:341, 1931.

7. Dwight, E. W., and Germain, H. H.: Thrombosis of the Cavernous Sinus, Boston M. & S. J. **146**:456, 1902.

8. Eagleton, W. P.: Intradural Conditions in Relation to Rhinology and Otology, Arch. Otolaryng. **10**:636 (Dec.) 1929.

been subject to headaches. In December, 1931, exposure to cold had resulted in the lips and nose swelling to twice their normal size. Heat relieved the condition This had continued each winter until the present illness.

Illness.—On March 23, 1933, the patient had eleven teeth extracted under local anesthesia because of dental caries. The following day the right side of her face was swollen, without any apparent systemic reaction. Three days later severe headache developed in the right temporal and occipital regions. This persisted for three weeks. The patient then complained of double vision, ptosis of the right eyelid and inability to move the right eye. The pain was accompanied by nausea. The referring physician (Dr. D. W. Thompson) reported complete ocular paralysis on the right.

Other findings, including the results of physical and laboratory examination and examination of the spinal fluid, were negative.

Consultation (Dr. W. E. Ash, May 8).—Neurologic examination showed paralysis of the third, fourth and sixth cranial nerves. The reflexes, gait and station, Kernig's sign, motor power, speech, sensation and coordination were normal. There was some rigidity of the neck, which was more pronounced on the right side. The pulse rate was 84, the temperature 98.6 F., the respiratory rate 24 and the blood pressure 126 systolic and 82 diastolic. Examination of the heart and lungs, the abdomen and pelvis, the skeletal system and the endocrine system gave negative results. Laboratory examination showed normal urine; 4,890,000 red blood cells with hemoglobin 89 per cent and 13,450 white blood cells, with 79 per cent polymorphonuclears. The spinal fluid was clear, with a pressure of 18 mm. of mercury and a cell count of 2. The Wassermann reaction of the blood and spinal fluid was negative. Roentgenograms of the sinuses showed nothing abnormal.

Diagnosis.—The condition was diagnosed as aseptic thrombosis due to dental trauma and abscess of the brain with localized meningitis.

Progress.—The condition remained unchanged until May 12, when a slight rise in temperature to 99.4 F. occurred. On May 13 the white blood cells numbered 10,850. The temperature continued to rise slightly; the white blood cells dropped to 9,400 on May 15. The patient complained of frontal headache, but ate and rested well. On May 15 she complained of severe pain in the back of the head and neck, and the temperature rose to 100.4 F. On May 16 it rose to 102.8; the patient had a slight chill; there were 9,950 white blood cells, with 84 per cent polymorphonuclears. Nausea and vomiting occurred. The spinal fluid showed a pressure of 18 mm. of mercury and 120 cells, all of which were reported to be mononuclears, and globulin 2+. The neck was rigid.

Consultation (Dr. J. J. Keegan, May 16).—The history of the onset was rather closely connected with the extraction of the upper teeth on the right. This was followed by pain in the right temporal and mastoid regions, extending three weeks later to the right eye, and then by diplopia within from two to three days later and paralysis of the right ocular muscles. Neurosurgical examination showed paralysis of the third, fourth and sixth cranial nerves on the right, with questionable prominence of the right eyeball. The right optic disk was not elevated; the margins were distinct; the veins were moderately engorged, and there were no retinal hemorrhages, no conjunctival edema and no congestion. The left eye was normal. There was no involvement of other cranial nerves. Motor power, sensation, reflexes and coordination of the trunk and extremities were normal. The

neck and thigh were definitely resistant to forward flexion. The spinal fluid showed a pressure of 14 mm. of mercury and 160 cells, all of which were reported to be mononuclears.

Diagnosis.—The diagnosis was right cavernous sinus thrombosis, either of a low grade infectious type or aseptic, with beginning penetration into the meninges. Operative intervention did not seem warranted. Repeated spinal drainage was recommended.

Progress.—Severe pain in the suboccipital region continued, with the temperature between 99 and 102 F.; there were no chills. On May 18 the white blood cells numbered 9,000, with 81 per cent polymorphonuclears; on May 19 the count was 8,250, with polymorphonuclears 82 per cent, and on May 21, 11,950, with polymorphonuclears 78 per cent. On May 19 the spinal fluid showed a pressure of 20 mm. of mercury and 20 cells. The patient complained of pain in the left eye on May 20, and the headache and rigidity of the neck were worse.

Consultation (Dr. A. M. Dean, May 22).—Ophthalmologic examination showed ptosis and slight proptosis of the right eyelids. (The wrinkles of the lids were somewhat obliterated.) The veins of the conjunctiva were normal, showing that the ophthalmic veins were patent. There was slight movement of the right eye, chiefly downward. The pupil reacted promptly to light. The reaction was slight and tended to hippus, which may be normal at the patient's age. The veins of the fundus were strikingly tortuous and engorged, with pressure by arteries at the crossings. The disk appeared to be within normal limits. The movements of the left eye seemed normal; the pupil was of the same size as that of the right eye and reacted in the same fashion. The retinal veins were perhaps at the upper limit of normal tortuosity. The disk appeared to be within normal limits. There was involvement of the third, fourth and sixth nerves on the right (excepting the sympathetic nerves) and of the retinal veins. The first and second branches of the fifth nerve on the right and the ophthalmic veins were not involved.

Diagnosis.—The ophthalmologic findings were not typical of those in cavernous sinus thrombosis. The small amount of exophthalmos spoke against an orbital growth. Antisyphilitic treatment was advised in the face of a negative Wassermann reaction and an irrelevant history.

Consultation (Dr. J. J. Keegan, May 23).—The pain and tenderness in the right anterior cervical region, which were increased by compression of the left jugular vein, were suggestive of extension of the cavernous sinus thrombosis back through the inferior petrosal sinus to the jugular bulb. Spinal puncture showed an initial pressure of 10 mm. of mercury, with a prompt rise to 26 mm. on compression of the left jugular vein and no rise on compression of the right jugular vein. This would fairly definitely establish block of the right jugular vein at the time of examination. The cell count of the spinal fluid was 12; there was no globulin. Neurologic findings were limited to ophthalmoplegia on the right and rigidity of the neck.

Progress.—The temperature gradually subsided from 102 F. on May 23 to 99.4 F. on May 29. On May 26 the white blood cells numbered 11,200, with 79 per cent polymorphonuclears. The patient continued to complain of pain and stiffness in the back of the neck, but seemed to improve. She vomited occasionally. There was a rise in temperature to 100.2 F. on May 21, with gradual subsidence to 99.4 F. on June 6, accompanied by considerable relief from pain. On June 7 the temperature was 100.4 F., and the white blood cells numbered 9,000 with 80 per cent polymorphonuclears. There was a daily rise of temperature to 100 F.

until dismissal from the hospital on June 12. The patient continued to improve at home until June 20, when severe headache developed with rigidity of the neck and pain in the left eye. On June 25 she returned to the hospital with vomiting, severe general headache and mental confusion. The temperature was 98.4 F., the pulse rate 134 and the respiratory rate 34. White blood cells numbered 6,550, with 64 per cent polymorphonuclears. The spinal fluid was under a pressure of 35 mm. of mercury. Twenty-five cubic centimeters was removed. The cells numbered 230; these were chiefly mononuclears.

Consultation (Dr. A. M. Dean, June 26).—Ophthalmologic examination showed reaction of the pupils to light. There was no diplopia; muscular movements were normal except on looking to the left, when a coarse lateral nystagmus developed. The fundus of both eyes showed evidence of increased intracranial pressure, with tortuosity of the veins and beginning edema of the disks; these changes were more marked in the right eye, where the physiologic cup was eliminated. Central vision was good in both eyes on rough testing; the patient read type about the same size as Jaeger's test type 4 with subjectively poorer vision in the right eye. The fields by confrontation appeared normal, but the responses were slow. On June 27 there was partial ptosis of the right eyelid in the morning, which was scarcely noticeable in the evening, and lateral nystagmus on looking to the left could not be elicited. The fundi showed no marked changes.

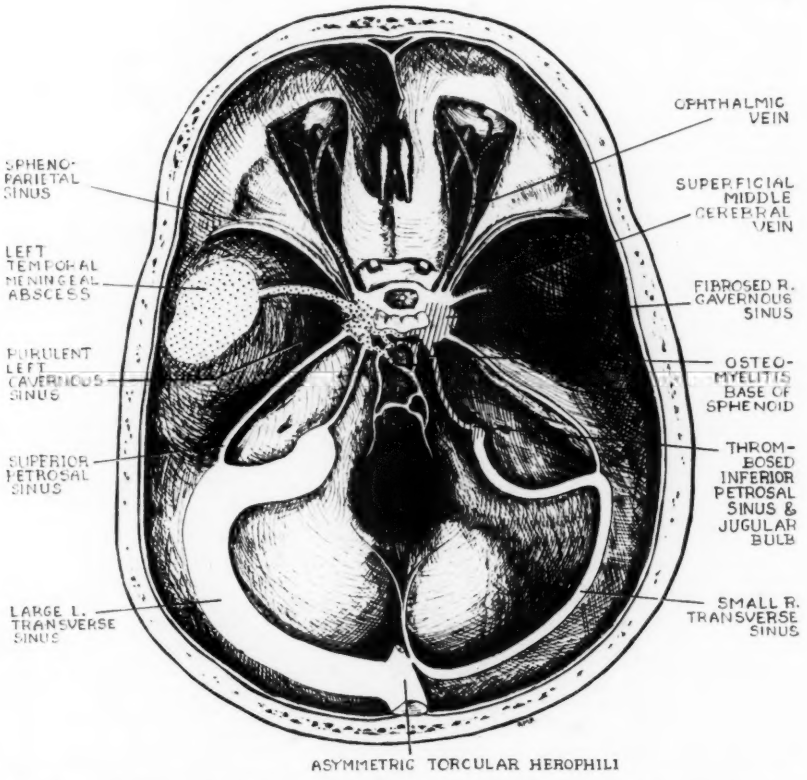
Suggested Diagnosis.—A diagnosis of localized meningitis near the cavernous sinuses was suggested.

Consultation (Dr. J. J. Keegan, June 27).—There was recurrence of severe headache and rigidity of the neck, with low grade fever and delirium. The blood count for leukocytes and polymorphonuclears was low. On June 26 the spinal fluid was under a pressure of 35 mm. of mercury; the visual fields were normal, and there was recurrence of the slight paralysis of the third and sixth nerves on the right. On June 27 the spinal fluid pressure was 8 mm. of mercury, with no rise on compression of the right jugular vein, but there was a prompt rise to 20 mm. on compression of the left jugular vein, with tenderness in the left side of the neck and increased pain in the head. Examination of the spinal fluid showed 219 cells, 80 per cent of which were monocytes; the fluid was faintly straw-colored. The fifth, seventh and eighth cranial nerves were normal. There was no palatal paralysis. The tongue protruded slightly to the right. The neck was rigid, and was tender and slightly swollen on the left side below the angle of the jaw. There was a slow rhythmic tremor of the right hand, which was most noticeable when the hand was at rest. The tendon reflexes were active; clonus and the palmar and plantar reflexes were normal, and the abdominal reflexes were present. There was no evident motor weakness. The patient did not cooperate well in the sensory tests, but was hyperesthetic to pain. On June 27 she was irrational, although her mental condition had been normal on admission.

Interpretation.—The condition was regarded as extension of right cavernous sinus thrombosis to involve the left side, with evidence of basal and nuclear involvement on the left. Surgical intervention was not warranted, in view of the normal spinal fluid pressure on June 27, with a low value for leukocytes and inadequate evidence of suppuration or localization of an abscess of the brain. It was suggested that if low intracranial pressure could not be maintained by repeated spinal drainage and intravenous hypertonic injection of dextrose, subtemporal decompression might be performed on the right with exploration of the right temporal lobe for an abscess, although the focal tremor in the right hand would point toward greater involvement of the left side.

Progress.—The fever remained low grade. The blood leukocytes numbered 9,250 on July 1, with 81 per cent polymorphonuclears. The patient continued to be irrational and restless. A rapid pulse rate and respiratory rate developed; respirations became of the Cheyne-Stokes type, and coma occurred, followed by death at 5:15 p. m., July 2.

Necropsy (Dr. A. S. Rubnitz, July 2).—Gross Examination (Limited to the Head): The skull cap was removed in the usual manner. The superior sagittal sinus contained no thrombus. The cerebral convolutions were moderately flattened,



Drawing of the base of the skull, showing involvement of the cavernous sinuses, the site of sphenoid osteomyelitis and the anatomic variation of the transverse sinuses.

and the cerebral vessels were injected. There was no subarachnoid exudate on the superior surface. In the left temple over the stem of the sylvian fissure the dura was adherent to the cortex, and when it was separated an abscess from 4 to 5 cm. in diameter was opened. This contained thick yellowish pus and appeared to lie on the surface of the brain. This infection was later found to be continuous with the left cavernous sinus through the superficial middle cerebral vein. As the brain was removed no purulent exudate was found in the basal subarachnoid cisterns. The dura over the base of the sphenoid bone back of the dorsum sellae was noted to have a roughened slightly hemorrhagic appearance; later dissection disclosed pus between it and the bone, with a necrotic perforated area in the base of the

sphenoid slightly to the right of the midline and extending deeply toward the foramen lacerum medium. No gross pathologic changes were seen in the adjacent internal maxillary region or in the petrous apex. The sphenoid air sinus lying just anteriorly was filled with a gelatinous mucus, with some reddening and exudate between the posterior part of the mucosa and the bone. The adjacent posterior ethmoid cells were clear, except for similar mucus.

Dissection of the cavernous sinuses disclosed that the left was filled with creamy pus, while the right appeared to be obliterated by fibrous tissue. Both ophthalmic veins were uninvolved, entering the anterior wall of the cavernous sinuses from the medial end of the superior orbital fissure. The transverse and sigmoid sinuses contained no thrombus, nor did the left inferior and superior petrosal sinuses. The sigmoid sinus and opening through the jugular foramen on the left were much larger than on the right; this was evidently an anatomic variation. Exposure of the right jugular bulb by removal of the petrous bone showed it to be small and apparently occluded by an organized thrombus. No blood could be forced through it by pressure over the jugular vein in the neck. Both cavities of the middle ear and both mastoids and petrous bones appeared normal.

Microscopic Examination: Section of the right caverous sinus showed the vascular spaces obliterated by dense fibrous tissue, with areas of infiltration by mononuclear cells. Section of the left cavernous sinus showed the venous spaces filled with cellular exudate characteristic of pus. Section through the right jugular bulb showed nerve trunks with considerable surrounding infiltration by mononuclear cells and on one side a mass of rather loose or young tissue densely infiltrated by polymorphonuclear and large mononuclear cells, interpreted to be a recent organizing thrombus. Section of the right inferior petrosal sinus showed obliteration by densely infiltrated fibrous tissue. Smears of the pus found showed gram-positive cocci in groups, which is characteristic of staphylococci. Cultures showed Staphylococcus albus.

COMMENT

The origin of this infection from the extraction of teeth might be questioned, as there was only moderate swelling of the face, which subsided within a few days with no systemic reaction or other evidence of active infection. However, the close relation of the time of onset to that of the extraction and the absence of any other evident infectious source make this etiology seem probable. A contributory factor may have been the susceptibility of the patient to marked edema of the face secondary to exposure to cold, which favored venous thrombosis.

The development of unilateral paralysis of the third, fourth and sixth cranial nerves on the right necessitated localization of the pathologic process in the right cavernous sinus, and the pain and low grade fever indicated an inflammatory lesion. The diagnosis of right cavernous sinus thrombophlebitis was made in spite of the absence of characteristic exophthalmos or chemosis.

The inflammatory process seemed low grade, possibly aseptic or recoverable without intervention, and palliative treatment was recommended. The appearance of tenderness in the right internal jugular region and evidence of block of the right jugular vein on spinal fluid

pressure test indicated extension of the thrombus to the right jugular bulb by way of the inferior petrosal sinus, which was found at necropsy. But an anatomic marked reduction in size of the right transverse and sigmoid sinuses and the corresponding jugular bulb may have contributed to the positive results in the spinal fluid pressure test.

The patient then gradually improved; the ophthalmoplegia on the right almost disappeared, and the conservative diagnosis and treatment seemed justified. In fact, the right cavernous sinus thrombophlebitis was found healed by complete fibrous organization at necropsy. However, the primary focus of the right basal sphenoid osteomyelitis continued active and later involved the left cavernous sinus, and a more active suppurative infection resulted, with spread along the superficial middle cerebral vein to form a meningeal abscess in the left temple.

These pathologic changes on the left did not manifest themselves in a typical manner. There was no ophthalmoplegia in the left eye, only some pain and congestion of the retinal veins. The suppurative infection caused swelling and tenderness in the left internal jugular region by reaction of adjacent tissues, without evidence of jugular block on this side. The rhythmic tremor of the right hand indicated involvement of the lenticulostriate nucleus and was probably due to interference with the venous drainage from this area or was secondary to the abscess in the left inferior temporal region.

The escape of both ophthalmic veins and of the third, fourth and sixth nerves on the left side in this case of proved bilateral cavernous sinus thrombosis is unusual, but emphasizes the fact that extensive and fatal cavernous sinus thrombophlebitis can occur without such involvement. The explanation is that the infection entered the sinus from the most posterior tributaries and was not very virulent, so that a protective reaction prevented spread forward into the ophthalmic veins. The anastomotic circulation of these veins through the facial and internal maxillary vein must have been adequate for venous drainage from the orbit.

The question of surgical therapy in this case and in other cases of cavernous sinus thrombophlebitis, as advocated by Eagleton,[1] seems to warrant discussion. This case demonstrates several facts concerning such therapy. First, the condition of the right sinus apparently healed without surgical drainage, which raises the question whether some of the reported cures of low grade cases of this condition by operation might not have occurred without intervention. The common acute fulminating cases are not amenable to any form of surgery, and it is difficult to see the rationale of sacrificing an eye for anterior drainage or endangering the meninges by a temporal approach, when there is some doubt whether such a meshwork as the cavernous sinus can be

drained successfully. Continued experimental work in this field is probably justified, but anatomic and pathologic facts should not be lost sight of in enthusiasm for surgical measures. The left cavernous sinus and the adjacent abscess of this patient might have been drained successfully through a left temporal approach, if the localization could have been more certain and if the sinus could have been reached safely without serious spreading of infection in the basal subarachnoid spaces.

INSTRUMENT FOR DETERMINING COURSE OF DARK ADAPTATION AND FOR MEASURING MINIMUM LIGHT THRESHOLD

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Aubert [1] in 1862 was the first to call attention to studies of dark adaptation as evidence of the sensitivity of the retinal elements. Since then numerous observers have tried to associate ocular disease with the abnormal course of dark adaptation. Notable among these have been Kleckowski,[2] Jess,[3] Shindler,[4] Tschenow [5] and Derby and co-workers.[6] Other investigators have studied the problem of dark adaptation, using either an apparatus of their own design, the Nagel adaptometer, or modifications of the latter. A review of these instruments has been given by Derby, Chandler and Sloan in their article on "A Portable Adaptometer." [7]

The subject becomes of greater importance in view of the fact that attention has been called to the value of dark adaptation as an aid in early diagnosis in cases of so-called "preglaucoma" (one eye normal and the other affected with glaucoma), in cases which show only one of the three cardinal symptoms of glaucoma—cupping, field and tension —in cases of presbyopia with a small cornea and shallow anterior chambers, and, lastly, in cases of "mooted excessive uveal pigment."

The encouraging results obtained in reviewing over two hundred cases warrant a description of the instrument used. It consists essen-

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Read before the Section of Ophthalmology, College of Physicians, Philadelphia, March 8, 1934.

1. Aubert, H.: Untersuchungen über die Sinnesthätigkeit der Netzhaut, Ann. d. Phys. u. Chem. **115**:87, 1862.

2. Kleckowski: Dark Adaptation of the Eyes, Arch. f. Augenh. **88**:253, 1921.

3. Jess: Ueber Adaptationsstörungen auf sympathischem Wege sowie Demonstration von Gesichtsfeldern bei erworbener Hemeralopie, Zuskft. d. Heidelberger ophth. Gesellsch. Aug. 1918, p. 217.

4. Shindler: Dark Adaptation, Klin. Monatsbl. f. Augenh. **68**:710, 1922.

5. Tschenow: Ueber Dunkeladaptation des Auges beim Glaukom, Russk. oftal. j. **1**:235, 1923; Zentralbl. f. d. ges. Ophth. **11**:123, 1923.

6. Derby, G. S.; Chandler, P. A., and O'Brien, M. E.: Tr. Sect. Ophth., A. M. A., 1928, p. 37. Derby, G. S.; Waite, J. H., and Kirk, E. B.: Tr. Am. Ophth. Soc. **24**:92, 1926. Waite, J. H.; Derby, G. S., and Kirk, E. B.: Tr. Ophth. Soc. U. Kingdom **45**:301, 1925.

7. Derby, G. S.; Chandler, P. A., and Sloan, L. L.: Tr. Am. Ophth. Soc. **27**: 110, 1929.

tially of a stimulus, *A*, placed at such a distance in front of the eye as to subtend a visual field of 30 degrees. This field can be a circular disk or, by the addition of the mask, *B*, a variable rectangular sector 3 degrees in width. One can rotate the mask into any position to study the sensitivity of the retinal surface for that position. This obviates a wrong answer by the patient, since the fixing point and the stimulus are regulated by the examiner. Derby [8] in explaining the errors in his

Instrument for determining the course of dark adaptation and for measuring the minimum light threshold: *A*, stimulus; *B*, rotating mask; *C*, controlling switch; *D*, control box; *E*, sector; *F*, filters; *G*, chart; *H*, headlight.

studies of the light sense in glaucoma claimed that a "patient in a dark room automatically selects his best field to see dim light." That explains why some definite cases of early glaucoma showed a normal light threshold with his and other instruments.

8. Derby, G. S.: Further Studies on the Light Sense in Early Glaucoma; Derby, Chandler, and Faissler, unpublished article, Library, Massachusetts Eye & Ear Infirmary, Boston, p. 8.

At the extreme end of the mask is a minute red light ($\frac{1}{200}$ inch [0.012 cm.]) which may be turned on or off, thus acting as a fixation point.

The stimulus is an opal glass illuminated from behind by a system of five miniature 2 candle power lamps, so controlled by a switch, *C*, that one, two, three, four or five lamps may be used. However, in studying dark adaptation, its course or the light threshold, only one lamp is used. The other lamps were installed to obtain the far greater illuminations necessary for further tests, especially those of visual acuity and chromatic threshold. These do not concern the present study.

Within the control box, *D*, is a special transformer called a "potor" which automatically maintains the voltage of each lamp constant at 6.2 volts, plus or minus 1 per cent, though the voltage of the alternating current line varies from 110 to 130 volts. The lamps are carefully seasoned and selected so as to insure long life and reliable illumination. The light from the lamp in the housing passes first through a ground glass diffusing plate and then through a Munsell filter, which rectifies the transmitted light from the Mazda bulbs to that comparable to "average north sky," a true white light. In front of the filters is an iris diaphragm which is controlled externally by a sector, *E*.

Since the radius of the sector is four times that of the diaphragm proper, the motion of the iris diaphragm from a minimum opening of 1 mm. diameter to a maximum opening of 33 mm. diameter is reproduced as a relatively larger motion of the sector. This makes possible a fine and exact adjustment of the diaphragm.

The sector is graduated into thirty-three divisions corresponding to the millimeter openings of the diaphragm of the iris in the instrument. With manipulation of the sector the light allowed through the iris diaphragm varies in quantity and thus illuminates the stimulus the light from which is controlled and accurately determined, since the quantity of light varies as the square of the opening of the iris diaphragm.

In addition to the control of the iris there are in front of the diaphragm two filters, *F*, which can be used either separately to give a transmission factor of 30 or 3 per cent, or combined to give a factor of approximately 1 per cent.

By the optical devices and controls indicated, the brightness of the stimulus can be varied from a minimum of 1 to a maximum of 500,000 micromillilamberts. Furthermore, the quality of the light remains unchanged, regardless of its intensity, because the quality of the light in its variations of illumination at *A* is unaffected by the opening or closing of the iris, by the use of neutral filters or by both.

On the outside of the sector a strip of paper can be fastened on which can be indicated easily and in the dark the eye under examination, the size of the opening of the diaphragm and notations relative to dark

adaptation. From these notations, by reference to the chart, *G*, the actual brightness of the stimulus is readily obtained. The result should be multiplied by either the Derby Waite or the Photon fraction for the size of the pupillary opening, to obtain a uniform result for purposes of comparison.

Within the "potor box" is a stop watch used in studying the course of dark adaptation, as, for example, when readings are made at five minute intervals.

A movable blinder, attached to the head rest, can easily be moved from one eye to the other without the patient's knowledge. This is a valuable asset in a subjective test of this kind. A 3 diopter lens may be used for accommodation when necessary.

A headlight, *H*, patterned after the one used by Selig Hecht, is used for light adaptation and contains a standard 100 watt light. It is held by the patient.

The procedure in the examination of a subject is the same as the one previously used by Derby and his co-workers:

1. The pupil of the patient is measured, and his vision is determined.

2. Three instillations of 1 drop each of pilocarpine nitrate are made into the eye at intervals of ten minutes. During the interval of waiting the patient is told what is to be expected of him in the examination; thus his fears are allayed, and he is willing to cooperate in helping to obtain better results.

3. Five minutes only are used for the study of light adaptation with the apparatus, *H*.

4. Readings for dark adaptation are made every five minutes, if a complete study of its course is desired, or the light threshold is determined in either twenty or thirty minutes. Jones [9] and Charpentier [10] regard twenty minutes of dark adaptation as suitable for practical purposes.

5. The opening of the pupil is again measured. This can be done with the corneal microscope. However, the use of a blank lens with eight concentric circles, 1 mm. apart, engraved on its face has been found effective for the same purpose.

6. The tension is measured.

The instrument commends itself for the following reasons: It occupies a small amount of space. When set up it measures 28 by 18 by 7 inches (71.12 by 45.72 by 17.78 cm.), and weighs 38 pounds (17.2 Kg.) net. The complete test can be accomplished with this instru-

9. Jones, L. W.: A Method of Measuring Nyctopsis with Some Results, Brit. J. M. Psychol. **2**:299, 1921.

10. Charpentier: Sur les variations de la sensibilité lumineuse suivant l'étendue des parties rétiniennes excitées, Compt. rend. Acad. d. sc. **91**:995, 1880.

ment which presents uniformity of scientific calibration. All the controls and recording mechanisms have been designed to secure quietness of operation. This concerns the opening of the iris diaphragm of the instrument, the use of Wrattan filters and the insertion of the recording paper. All the adjustments can easily be made by the examiner in the dark; thus the patient's attention is not distracted. Also, the patient does not know which eye is being examined and just what position the stimulus is in until his light threshold is reached. This is of advantage in a subjective test of this kind.

Findings will be reported at a future date when more definite data are obtained.

METASTATIC CARCINOMA OF THE OPTIC NERVE AND CHOROID

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AND
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Few cases of metastatic carcinoma of the optic nerve and choroid have been reported in the literature. In the case described in this report, it is debatable whether the metastasis was primarily in the nerve or choroid. A diagnosis of tumor of the optic nerve and choroid was made on the basis of the clinical signs and symptoms and proved by an examination of the enucleated eyeball in the laboratory. Regardless of whether the primary metastasis was in the choroid or in the optic nerve, the case is of great interest both clinically and pathologically because of its rarity.

REPORT OF A CASE

History.—Mrs. C. C., aged 42, an Italian housewife, was referred to Dr. Payne at the New York Eye and Ear Infirmary on Dec. 18, 1929. She was admitted to Dr. McDannald's service complaining of severe pain, complete blindness of the right eye and "drooping" of the right upper eyelid. She stated that the pain was practically unbearable and that there had been no sight in the eye for about two months. The eyelid became paralyzed approximately three weeks before her admission.

The family history revealed that her father had died at the age of 50 from a cerebral hemorrhage; her mother had died at 65 from an unknown cause. Her only sister was 47 years of age and healthy. There was no familial history of cancer or tuberculosis.

With the exception of an operation for appendicitis a few years before, the patient's past medical history was irrelevant. Menstruation began at 14, was irregular and small in amount and ceased at the age of 22. She had never been pregnant nor had any miscarriages, though married for twenty years. In February 1928, a painful mass appeared in the right breast. She was examined at the Roosevelt Hospital, where it was noted that she had "a slight discoloration of the right nipple with some retraction. The mass was hard and about the size of a lemon. From the roentgenogram it was decided that she had no metastases to the ribs, lungs, pleura, mediastinum or spine. A diagnosis of new growth was made and radical mastectomy was advised and performed. The pathologic report revealed carcinoma, group III, with metastases to the axillary lymph nodes. Convalescence was uneventful, but she was seen from time to time at the recall clinic. A course of intensive roentgen treatment was prescribed. The patient continued to improve until October 1929, when she returned for examination and it was found that she had a firm palpable node in the right supraclavicular region with blindness in the

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The patient was presented and a preliminary report made before the Section of Ophthalmology of the New York Academy of Medicine, March 1930.

right eye. She stated that the vision began to fail about two or three weeks before this visit and that the pain was almost unbearable at times." [1]

Clinical Examination.—The appearance of the patient was that of a fairly healthy woman of 40; her color was slightly pasty and dark but she did not appear particularly cachectic. She was from 10 to 15 pounds (4.5 to 7 Kg.) overweight. Her gait and coordination were normal. The right upper eyelid was ptosed, but there was no exophthalmos. The eye deviated upward and outward, and the power of adduction was lost; abduction was normal. The pupil was dilated and fixed, reacting neither to direct or indirect light nor in attempted convergence.

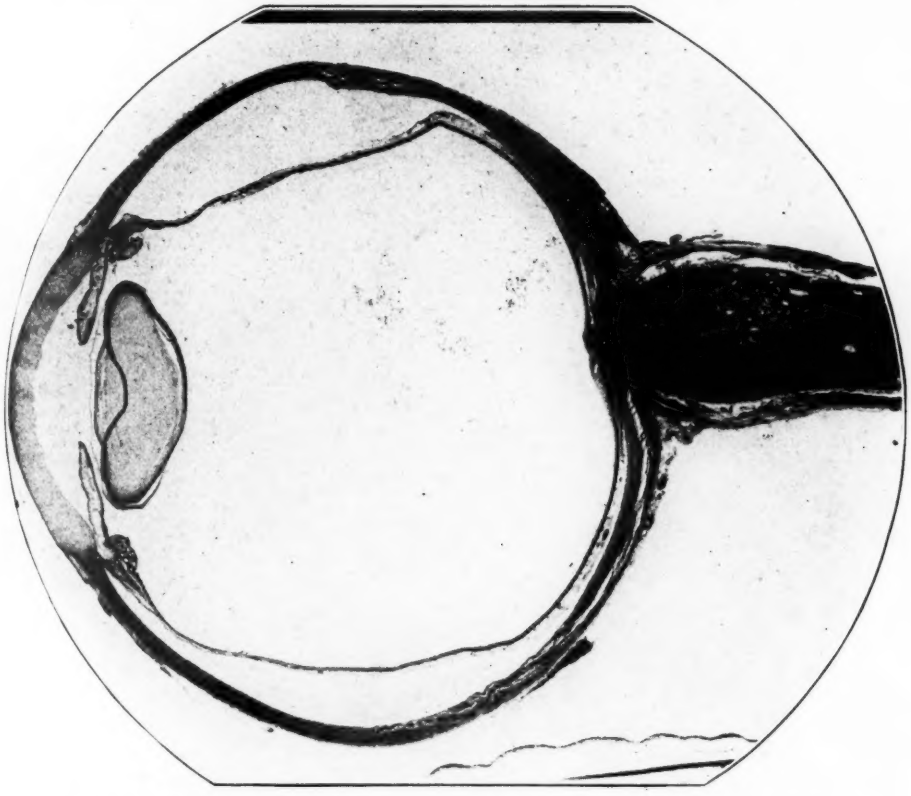

Fig. 1.—Photomicrograph of a section of the eye, showing the anterior two thirds normal in appearance. There is a flat detachment of the retina on one side, and the pial sheath of the optic nerve is filled with carcinomatous cells. The choroidal lesion is not well defined at this magnification.

A general physical examination showed chronically diseased tonsils and pyorrhea alveolaris, absence of the right breast with an operative scar, the liver and spleen within normal limits, the cardiovascular system normal and a midline operative scar left by an appendectomy. Examination of the pelvis revealed nothing abnormal, and the neurologic signs and symptoms were confined to the right eye. Examination of the nose and throat revealed nothing of importance.

1. Personal communication from Dr. James E. Thompson, who referred the patient to Dr. Payne.

The roentgenologist reported: "slight cloudiness in the temporal portion of the right orbit with haziness of the ethmoids and a normal sella turcica; an infiltration in the middle of the right lung and thickening of the pleura at the base of the left lung." The urine, Wassermann reaction and blood chemistry were essentially negative. The red blood cell count was 5,200,000, the hemoglobin, 98 per cent, and the white cell count, 7,250, with 28 per cent lymphocytes, 6 per cent monocytes, 64 per cent polymorphonuclears and 2 per cent eosinophils.

Vision was absent in the right eye and 20/20 in the left. The intra-ocular tension was 18 mm. of mercury (Schiötz) in both eyes. Field studies showed slight

Fig. 2.—Photomicrograph of the primary lesion in the breast, diagnosed as carcinoma, group III.

temporal contraction for form, with rather marked contraction for colors in the left eye. The blind spot was within normal limits.

Ophthalmoscopic Examination.—Examination of the right eye showed clear media and a normal fundus to within about 2 disk diameters of the optic nerve on the temporal side. At this point there appeared to be a slight elevation of the retina. It was continuous with a light gray, slightly elevated mass, which extended into the disk. The appearance of the nerve suggested mild papilledema, but careful examination revealed little swelling. Hemorrhages and exudates were absent. Blood vessels wound in and out of the mass undisturbed. No pigment was present, and the growth extended farther upward and temporally than nasally. There were

irregular shallow depressions on the surface of the mass, the shape of which was approximately oval. Ophthalmoscopic examination of the left eye revealed no pathologic condition.

Course.—A clinical diagnosis of metastatic carcinoma of the optic nerve and choroid was made because of the history of radical mastectomy for cancer of the breast and the gross appearance of the lesion in the eye, the total amaurosis of the right eye, the normal appearance of the fundus except in the region of the disk, the severe headaches without sign of irritation in the eye suggesting intracranial involvement and, finally, the paralysis of the third and fourth nerves and temporal contraction of the left fields, which suggested the possibility of metastasis.

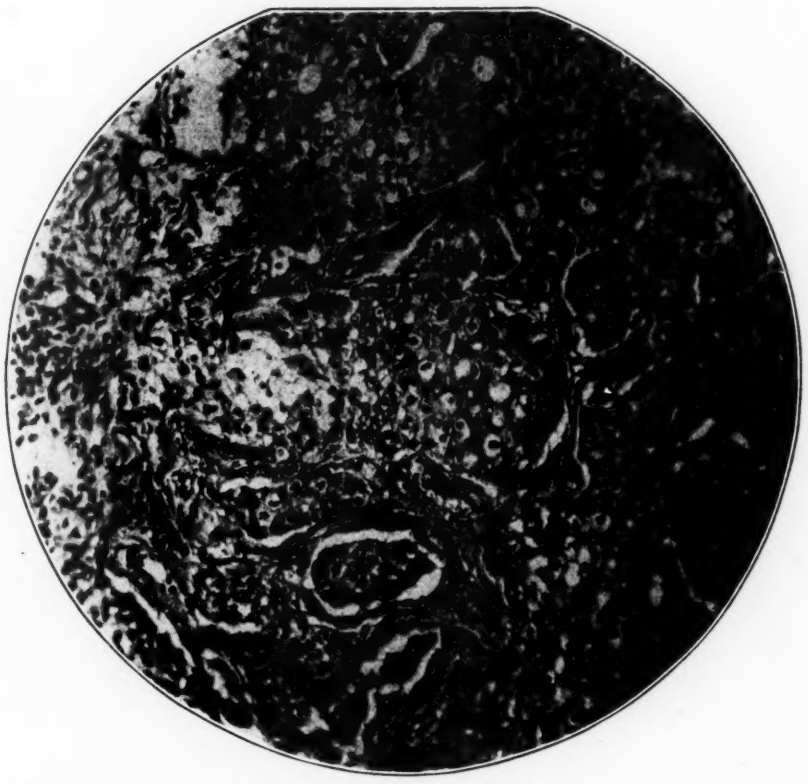

Fig. 3.—Photomicrograph showing invasion of an axillary lymph node by the new growth. The size, shape, staining and general arrangement of the cells correspond to those observed in the eye.

Enucleation for the relief of intense pain in the eye was advised and performed on Dec. 20, 1929. The patient was comfortable after the operation, and when the reaction had subsided treatment with radium was ordered. She was discharged from the hospital and seen in the clinic at regular intervals. About five months after the operation she was placed in a home for incurable persons. She died on June 26, 1930. Permission to perform necropsy was not obtained.

Pathologic Examination.—Examination of the specimen showed that the anterior and middle zones of the eye were normal, with the optic nerve severed 15 mm.

Fig. 4.—Photomicrograph showing the involvement of the optic nerve with extension into the choroid and retina. The pial sheath, septums and central vessels are not penetrated by the growth.

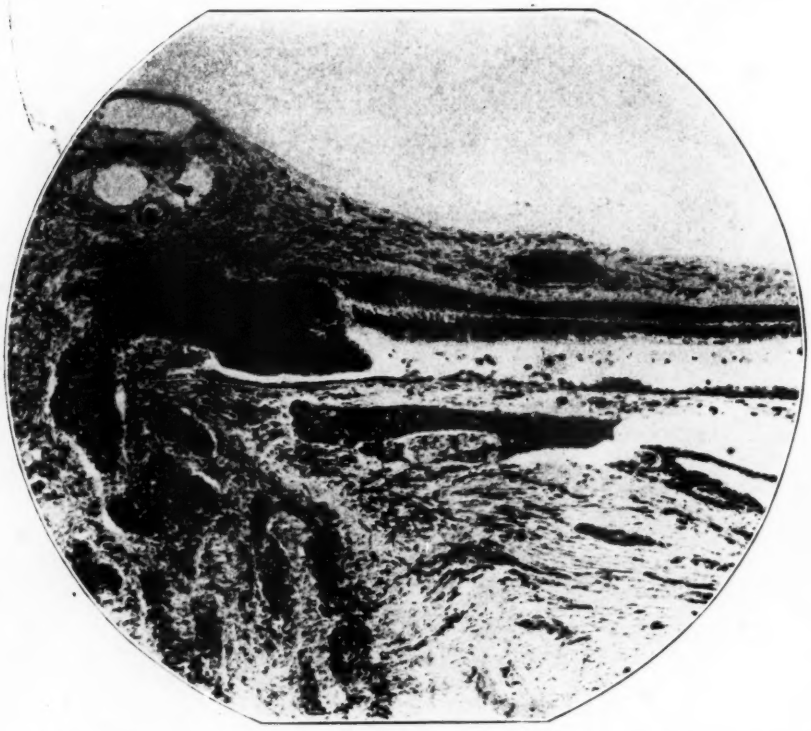

Fig. 5.—A high power study of the preceding section at the disk margin. The cells are extending into the retina and choroid. The retina is in the process of becoming detached.

back of the sclera and enlarged to a diameter of 7 mm. just back of the cribriform plate. It gradually assumed its normal thickness as the end was approached. The dura and arachnoid, as well as their underlying spaces, were well defined and uninvolved. Carcinomatous cells filled the connective tissue septums with the exception of a small area immediately adjacent to the pia mater on the nasal side posteriorly. This area was seen in only a few of the sections. There was no invasion of the connective tissue septums, the nerve fibers being replaced by rather large, hyperchromatic, irregularly round cells, which left a few cystic spaces filled with a clear fluid having the staining properties of lymph. There were some areas of necrosis, and in various places the cells showed beginning fatty degeneration.

The new growth permeated the cribriform plate and involved the disk by replacing the nerve fibers in a tuftlike arrangement, giving the appearance of papilledema. Adjacent to this, it attacked the retina and appeared in the choroid and the subchoroidal space, probably causing the detachment of the retina on the temporal side. The carcinomatous cells tended to group themselves into close, compact tufts in some areas of the choroid. In other locations they attempted to form glandlike tubules, with some of the cells loose in what appeared to be the lumen. The involvement of the choroid corresponded to the clinical picture. A few cells were found in the lamina fusca of the sclera near the detachment. The blood vessels of the retina were distended and the nerve fibers and ganglion cells were preserved. The retina was detached in fixation, and the vitreous had fallen out of the sections.

The type of cell corresponded to that observed in the breast and the axillary lymph nodes, which was diagnosed at the Roosevelt Hospital as carcinoma, group III. The final diagnosis was metastatic carcinoma of the optic nerve and choroid with slight invasion of the sclera and retina.

Sections were studied by Dr. Algernon B. Reese, who gave the following opinion: "I believe unquestionably that the carcinoma metastasized primarily in the optic nerve and that the choroidal involvement is secondary for the following reasons:

"1. The tumor is seen filling the entire nerve and represents the large majority of the lesion of the eye. The choroidal involvement is obviously an overflow from the nerve by way of the border tissue and represents a small portion of the lesion.

"2. The loose, highly vascular areolar tissue of the choroid is an ideal medium for neoplastic growth, particularly in contrast to the dense, relatively avascular tissue of the optic nerve.

"Had the tumor implanted itself primarily in the choroid, it is highly probable that it would have grown more extensively there in preference to invading a denser and less vascular tissue through the barrier of the border tissue. This is borne out by the behavior of primary metastatic carcinoma of the choroid. In such instances, the optic nerve is almost never involved. When such involvement does occur, it is very slight, and it is only seen in cases of extensive growths in the choroid. A melanosarcoma of the choroid practically never invades the optic nerve." [2]

COMMENT

The rarity of metastasis of new growths to the eye is ascribed to the right-angled origin of the ophthalmic artery from the internal

2. Personal communication from Dr. A. B. Reese.

carotid. Uhthoff [3] saw 1 case in 30,000; Sattler [4] reported 2 in 300,000, and 2 cases [5] were seen at the New York Eye and Ear Infirmary in 70,000 patients. The condition generally occurs in the eye from one to two years after the primary growth is diagnosed. Cases have been reported from ten to fifteen years later. Such organs as the liver, lungs, brain, kidneys and pancreas may be affected at the same time. Parsons [6] stated that the average longevity after appearance in the eye is nine months, while other authors have estimated it as from six months to a year. Our patient lived fourteen months after the first ophthalmic symptoms. The most common source of metastasis is from the breast. Hegner [7] claimed that 65 per cent of cases are derived from the breast and about 10 per cent from the lungs and that from 65 to 70 per cent occur in women. Krukenberg [8] reported 37 cases in females, in 30 of which the primary carcinoma was in the breast, in 1 in the thyroid gland; in 1, in the suprarenals, and in the remainder, in the lungs or stomach. Usher [9] reported 62 cases of metastasis from the breast.

The choroid in the vicinity of the posterior pole of the eye is the usual site of first invasion. This is attributed to the increased vascularity and the entrance of the short posterior ciliary arteries. The iris and ciliary body may be affected, and rarely the optic nerve. The initial lesions are usually flat pale gray areas. There may be one or several. The elevation is seldom over 1 or 2 mm., and a flat detachment of the retina may surround the process. The foci spread laterally as a rule. Occasionally, the growth may break through the retina and invade the vitreous, but generally the vitreous remains clear and there is little sign of inflammation until late. Hemorrhages occasionally occur with necrosis of the central areas. The tumor may invade the disk and destroy the fibers of the optic nerve upward into the brain.[10] Secondary glaucoma develops much later than in cases of sarcoma, but pain seems to arise earlier, frequently requiring enucleation for its relief.

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3. Uhthoff, W.: Internat. Beitr. z. wissensch. Med., Festschr. für R. Virchow **2**:423, 1891; Deutsche med. Wchnschr. **30**:1423, 1904.

4. Sattler, H.: Die bösartigen Geschwülste des Auges, Leipzig, S. Hirzel, 1926, p. 221.

5. Payne, B.: Texas State J. Med. **28**:227 (July) 1932.

6. Parsons, J.: Pathology of the Eye, Rep. Roy. London Ophth. Hosp. **15**: 286, 1903.

7. Hegner, C.: Klin. Monatsbl. f. Augenh. **49**:105, 1911.

8. Krukenberg, E.: Klin. Monatsbl. f. Augenh. **41**:145, 1903.

9. Usher, C.: Brit. J. Ophth. **8**:38 (Jan.) 1923.

10. Davis, W. T.: Metastatic Carcinoma of the Optic Disk, Arch. Ophth. **8**: 226 (July) 1932.

INVOLVEMENT OF THE CORNEA IN ARSENIC POISONING

REPORT OF A CASE

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Arsenic poisoning is seen with comparative frequency in medical practice and may be acquired in many ways, as (1) with suicidal intent, (2) through the medicinal use of arsenic and (3) accidentally.

The condition has been known to develop after baiting rat traps with poisons, from using patented mouthwash,[1] from drinking wine made from grapes sprayed with insecticides,[2] or even from ingesting the arsenic naturally present in drinking water.[3]

The manifestations of arsenic poisoning are possibly as varied as those of syphilis, but in the medical literature there could be found reports of only four cases of arsenic poisoning involving the cornea, and all of them resulted from the use of arsenicals in the treatment of syphilis.

REPORT OF A CASE

History.—R. T., a colored boy, aged 7, was brought to the ocular clinic of Grady Hospital on Feb. 20, 1933, complaining of poor vision and a growth inside the left lower lid. This trouble followed a severe illness eighteen months previously. Later in conversation with the physician [4] who attended the patient during this illness it was learned that in July 1931 the patient was extremely ill for three or four weeks after eating peaches from a tree that had been recently sprayed with an insecticide. The physician said that the patient had had a typical case of acute arsenic poisoning that began with conjunctivitis and included nausea, vomiting, colicky pains, bloody diarrhea, suppression of urine, a high temperature, delirium, convulsions and a marked exfoliative dermatitis with

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Read before the Fulton County Medical Society, Atlanta, Ga., Feb. 1, 1934.

From the Department of Ophthalmology, Emory University School of Medicine.

1. Lowenburg, H., and Naide, M.: Arsenic Poisoning Caused by Mouth Wash Containing Solution of Potassium Arsenite, J. A. M. A. **100**:737 (March 11) 1933.

2. Ledoux, E.: Poisoning from Wine Made from Grapes Sprayed with Arsenical Insecticides, Bull. et mém. Soc. méd. d. hôp. de Paris **50**:1566 (Nov. 18) 1926.

3. Corbella, R. G.: Chronic Poisoning from Arsenic Naturally Present in Drinking Water; First Case Known in Province of Buenos Aires, Semana méd. **2**:904 (Oct. 23) 1924.

4. Duvall, W. B.: Personal communication to the author.

secondary infection involving the skin of all parts of the body, the mucous membrane of the mouth and the conjunctiva. The lids were markedly swollen, and ulcers developed on both corneas with perforation of the left. The hair came out and all the toe-nails and finger-nails became loose and dropped off. Prior to the acute illness he had had an occasional light epileptic seizure, but since then the seizures had been much more frequent and severe. The Wassermann reaction of the blood was repeatedly negative. The treatment during the acute illness was symptomatic and sodium thiosulphate was used intravenously. A brand of phenobarbital had been given regularly to control the epilepsy.

Examination.—Physical examination showed the patient to be well developed and well nourished but below normal size for his age. His hair and nails had reappeared, but the nails were rough and not well formed. There were many large, flat, irregular scars on various parts of the body. No paralysis or atrophy of the muscles was noted. He was timid but mentally alert.

Fig. 1.—Opaque corneas and subconjunctival cyst due to arsenic poisoning.

The visual examination showed that on the right side fingers were perceived at 3 feet (91 cm.). Light perception was absent on the left side.

There was a large subconjunctival cyst (fig. 1) 1.5 by 1.5 cm., arising from the left lower culdesac temporally, pushing the lower lid out and extending up 2 mm. above the upper margin of the lower lid. The motility of the eyes was normal except for slight limitation in their extreme excursions because of adhesions between the palpebral and ocular conjunctiva. The conjunctiva was dry, thick and leathery; the crypts and folds in the shallow lower culdesacs contained cheesy débris and mucopurulent material.

The tension of the right eye was normal. The cornea was gray, dry, lusterless and almost insensitive, and in its lower two thirds was more densely opaque than in its upper one third. The cornea did not stain with fluorescein. The anterior chamber was of normal depth, and the pupil as seen through the upper part of the cornea was round and active. The iris appeared normal. The fundus was not observed. Slit-lamp examination of the cornea showed that the surface of the epithelium was comparatively irregular and very opaque, so that the details of the underlying layers of the cornea could not be discerned.

The left globe was shrunken and soft. The cornea was almost flat and exhibited a similar but more advanced condition than that of the right cornea. There was a dense central adherent leukoma.

Irrigations with solution of boric acid were prescribed three times daily followed by instillation of castor oil to keep the conjunctiva and cornea clean and lubricated. Ethylmorphine hydrochloride was prescribed for the right eye, to be used at bedtime. The left eye was enucleated, and the conjunctival cyst was dissected on March 9, 1933. An iridectomy above was performed on the right eye on Aug. 3, 1933, but as this did not materially aid his vision the patient was admitted to the State School for the Blind on Jan. 8, 1934.

Histologic Study.—Histologic examination of the left eye (fig. 2) showed that the corneal surface was irregular and covered by several new layers of epithelium. The epithelium varied much in thickness, and the outer cells were flat and trans-

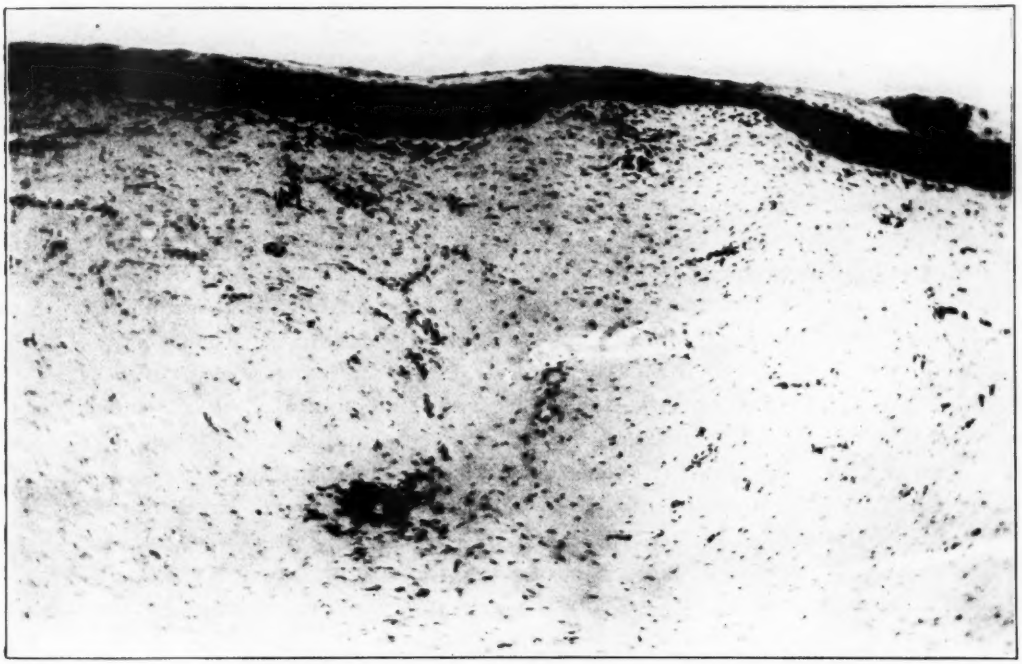

Fig. 2.—Section of the corneal surface of the left eye.

lucent, not unlike epidermis. Bowman's membrane was completely destroyed, and almost all of the outer one third of the stroma was replaced by vascular fibrous tissue. Descemet's membrane was present but wavy because of the contraction of the cornea. Through the center of the cornea was a scar from an old perforation, from which a dense band of fibrous tissue passed posteriorly to the nerve head. The atrophied iris and ciliary body were drawn into the mass of fibrous tissue and extended into the cornea. The retina was completely detached and caught in the strand of fibrous tissue that had contracted and drawn the nerve head into the vitreous cavity. The choroid was atrophic and attached to the sclera.

COMMENT

The patient presented most of the outstanding textbook symptoms of chronic arsenic poisoning, except those indicative of an action on the peripheral nerves giving rise to polyneuritis and atrophy of the mus-

cles involved. The sensory and motor paralysis, especially of the extremities, closely resembled locomotor ataxia, lead poisoning and alcoholic neuritis. Underhill [5] even mentioned that "paralysis of sensation may involve the eye and produce blindness, and if the period of poisoning is prolonged the individual sinks into an apathetic, semi-idiotic condition or indeed may become epileptic." The chronic form of poisoning may result from repeated administration of small doses or from the ingestion of a single large dose. An amount as small as 1½ grains (0.1 Gm.) may be fatal.

The first somewhat similar case was reported in 1917 by Hegner.[6] Diffuse erythema and exfoliative dermatitis developed after the third injection of neoarsphenamine. Associated with the dermatitis there occurred an unusual ocular change commencing as a croupous conjunctivitis followed by a clouding of the lower half of the cornea which eventually became diffuse. Subsequently the cornea underwent necrosis and perforation and a panophthalmia that necessitated enucleation developed. Streptococci were demonstrated in the tissue. Zimmerman [7] debated the question as to whether there was an actual toxic degeneration of the cornea with subsequent secondary infection or whether the corneal lesion was entirely dependent on a pyogenic infection so commonly complicating the grave exfoliative dermatitis resulting from the administration of the arsphenamines. He concluded that the only true toxic arsphenamine reaction involving the normal eye occurred in the form of conjunctival hyperemia, but that further damage may result to retinal vessels already involved by cardiovascular and renal disease. However, in syphilis, general or ocular, a Herxheimer reaction may manifest itself as an intensification of an active lesion, as an activation of a quiescent lesion or as the unexpected appearance of changes in structures previously presenting no clinical evidence of a pathologic process.

Three cases of corneal involvement from the administration of neoarsphenamine in the treatment of syphilis were reported by Kirby [8] in 1929. In the first case exfoliative dermatitis of the skin and corneal epithelium of both eyes developed following the fourth injection. In the second case exfoliative dermatitis and ulcers developed after the seventh weekly injection. The arsenical was discontinued, and two years later there was a recurrence of the dermatitis that also involved the

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5. Underhill, F. P.: Arsenic Poisoning, in Toxicology, Philadelphia, P. Blakiston's Son & Co., 1924, p. 93.

6. Hegner: Schwere Hornhautnekrose bei Salvarsanvergiftung, Klin. Monatsbl.f.Augenh. **59**:624 (Aug.) 1917, quoted by Zimmerman.[7]

7. Zimmerman, E. L.: Rôle of Arsenic in Production of Ocular Lesions, Arch. Ophth. **57**:509 (Sept.) 1928.

8. Kirby, D. B.: Keratitis Exfoliativa Complicating Dermatitis Exfoliativa, Arch. Ophth. **2**:661 (Dec.) 1929.

corneas and the conjunctiva of both eyes. In the third case severe dermatitis with conjunctivitis and keratitis of each eye developed following the fifth weekly injection. The cornea progressed to a condition that had the appearance of necrosis with sloughing and perforation. Secondary infection followed, and evisceration was necessary. The left eye healed without complications. These three patients were given sodium thiosulphate intravenously, and after the acute symptoms subsided the first two were subjected to surgical removal of the diseased corneal epithelium. After administration of cocaine this was accomplished by scraping with the curet and a tightly wound cotton applicator. This was followed by the application of a 3.5 per cent solution of tincture of iodine. Healing was hastened and approximately normal vision was preserved in each eye.

The cutaneous reaction from arsenicals has been considered to consist of angioneurotic phenomena [9] in almost the entire body and the first symptoms to be typical vasomotor disturbances. Accumulation of arsenic in the skin has been proved by analysis of the scales representing dead parts of the skin involved, which show that the amount of arsenic in the skin increases with the increasing severity of cutaneous lesions. Arsenic has likewise been found in the urine and feces. Nearly twenty years ago attention was called to the fact that congestion of the conjunctiva was usually the first symptom of arsenic poisoning, and its appearance during the course of treatment of syphilis warns of danger and calls for longer postponing of the following injection of an arsenical.[10]

Other conditions, as ocular pemphigus,[11] xerosis conjunctivae and keratomalacia,[12] may produce similar external lesions of the globe, but they are conclusively differentiated as a possibility in the case presented when the history of the antecedent acute illness and the subsequent course of the patient are considered.

SUMMARY

1. Corneal involvement in arsenic poisoning is a rare complication.

2. The corneal changes may be due to actual toxic degeneration and an exfoliation involving the corneal epithelium similar to the cuta-

9. Myers, C. N.; Muller, E. F., and Metz, G. P.: Arsenic Lesions of the Skin, Arch. Dermat. & Syph. **15**:186 (Feb.) 1927.

10. Milian: Conjunctivitis Due to Arsenicals, Paris méd. **11**:303 (Oct. 15) 1921.

11. Pusey, W. A.: Pemphigus, in The Principles and Practice of Dermatology, ed. 4, New York, D. Appleton and Company, 1924, p. 281.

12. Fuchs, E.: Xerosis Conjunctivae and Keratomalacia, in Diseases of the Eye, translated by E. V. L. Brown, Philadelphia, J. B. Lippincott Company, 1933, p. 119 and 178.

neous lesions, followed by secondary infection, but it is quite likely that trophic changes following disturbance of sensation should also be considered.

3. Probably the best form of treatment of this corneal complication is the surgical removal of the diseased epithelium followed by the application of a 3.5 per cent solution of tincture of iodine.

4. Conjunctivitis during the course of arsenical treatment of syphilis may be a warning to lengthen the interval between injections.

478 Peachtree Street.

Clinical Notes

CHRONIC IRITIS WITH BLOOD VESSELS ON THE LENS

EDWIN S. MUNSON, M.D., NEW YORK

The case reported here presented profuse vascular invasion of the surface of the lens and an unusually long-standing condition of the iris. As I had no recollection of having seen a similar proliferation of the blood vessels, and as there were so few references to cases of this type in the literature, I decided to photograph the eye and present a clinical report.

REPORT OF A CASE

A man, aged 56, applied for treatment at the New York Ophthalmic Hospital in September, 1932. He stated that he had been struck in the left eye with a stone forty-four years previously, and that directly after the injury he could distinguish only large objects. The sight gradually failed. The eye was free from pain but was always a little red.

The appearance of the right eye was normal, and the vision was 20/30, uncorrected. The left eye was blind, and presented a moderate pericorneal injection of a chronic appearance. The cornea was clear. The iris was of a dull grayish color and lacked luster. There was no bulging of the iris; the anterior chamber was a little deeper. The pupil was partly dilated and oval, narrowed below, the long axis running from 11 to 5 o'clock. Failure of the pupil to dilate following the use of atropine gave evidence of posterior synechia. The lens was opaque and of a light grayish color (which does not show in the picture). The tension was normal.

A large number of small, red blood vessels (easily seen with the unaided eye) beginning in the connective tissue at the periphery of the iris, some appearing to emerge from the crypts, pursued a straight or tortuous course toward the pupil. Some of these stopped at the pupillary border, or ran along its edge, but many of them passed over onto the surface of the lens, with frequent anastomoses. As these vessels did not show so plainly in the photograph, they were touched up by a medical artist, under direct observation of the eye.

A close inspection failed to reveal any scar of the sclera, cornea, iris or lens to indicate a penetrating wound.

A diagnosis of chronic iritis and traumatic cataract, with vascular invasion of the surface of the lens, was made.

From the appearance and the condition of the eye, it was my opinion that the pathologic changes were confined to the iris and to the anterior part of the lens. If the ciliary body had been affected to any extent, there would have been reduced tension, an atrophied eyeball and probably a morgagnian cataract. The patient failed to return for slit-lamp examination.

A search was made in the available works on ophthalmology and in year books for the past twenty years, but only five brief notations of

cases of this kind were found. If the condition is common, as one writer stated, it seems strange that it has received such slight notice when other abnormalities are described most minutely.

In discussing endophthalmitis septica, in the mild form confined to the anterior part of the globe, Fuchs [1] stated:

> The iris is then overlaid by a connective tissue membrane, many times of considerable thickness and containing new-formed vessels; these have grown out of the iris into the connective tissue. From the surface of the iris this membrane (iritic membrane) grows over the surface of the lens in the expanse of the pupil and closes the pupil. In addition its blood vessels may go over onto the pupil

Appearance of the eye.

with the membrane; such pictures are falsely spoken of as vascularization of the lens capsule.

Koby,[2] Collins and Mayou [3] and Bedell [4] were the only other authors noted that made any mention of new vessels on the iris and lens.

1. Fuchs, E.: Diseases of the Eye, translated by E. V. L. Brown, ed. 10, Philadelphia, J. B. Lippincott Company, 1933, p. 293.

2. Koby, F. E.: Slit-Lamp Microscopy of the Living Eye, translated by Charles Goulden and Clara Harris, Philadelphia, P. Blakiston's Son & Co., 1925, p. 130.

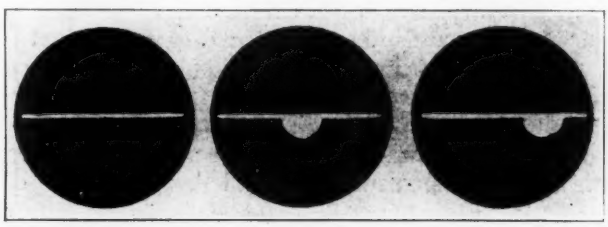
3. Collins, E. T., and Mayou, M. S.: Pathology and Bacteriology of the Eye, Philadelphia, P. Blakiston's Son & Co., 1925, p. 467.

4. Bedell, A. J.: The Iris in Health and in Disease as Seen with the Slit Lamp, J. A. M. A. **79**:355 (July 29) 1922; The Lens as Seen with the Gullstrand Slit Lamp and Corneal Microscope, ibid. **82**:363 (Feb. 2) 1924.

PRACTICAL USE OF THE STENOPEIC SLIT LENS

FREDERICK J. HOITASH, M.D., HUNTINGTON, W. VA.

Little is mentioned in the literature about the practical use of the stenopeic slit lens to improve the vision. I have ordered smoked glasses for several of my patients in which the principle of the stenopeic slit is used. With spectacles of this type, the visual field is diminished; however, the blur arising from aberration, regular or irregular astigmatism, etc., is considerably, and at times completely, eliminated. To enlarge the visual field, I widen the stenopeic slit by a semicircular opening either in the center or toward the nasal side, according to the need



Stenopeic slit lens showing variation in the size of the opening.

for distant vision or for close work. The average width of the slit is from 1.5 to 2 mm.; the diameter of the semicircular opening varies from 3 to 6 mm. as shown in the illustration.

In eyes with corneal leukoma, congenital nuclear cataract and other opacities of the transparent media, the vision can be considerably improved by the use of these glasses; in eyes in which an optic iridectomy has to be performed without sparing the sphincter iridis, which is usually the case, stenopeic slit lenses offer protection against too much light. Generally, the slit is put in the horizontal meridian, but in some cases the axis deviates slightly from this position. Also, the slit is very useful in photophobia. The stenopeic slit lens may be used binocularly and monocularly, with or without correction of the refraction, and it may be hooked over another lens.

News and Notes

GENERAL NEWS

Transactions of Fourteenth International Ophthalmological Congress.—Three volumes have been published containing the addresses which were delivered at the Fourteenth International Ophthalmological Congress at Madrid in 1933. These include addresses on tuberculosis of the iris and ciliary body, detachment of the retina and trachoma. Five supplementary volumes have now appeared, written in the language in which the discussions were delivered. Three of the five supplementary volumes are interesting for their individual content: the first deals with retinal detachment; the second includes the special contribution prepared for the congress by Professor Ramón y Cajal, and deals with the histologic and physiologic problems of the retina; the third comprises the transactions of the two international organizations concerned with antitrachoma measures and the prevention of blindness.

SOCIETY NEWS

British Medical Association.—The association will hold its one hundred and second annual meeting at Bournemouth, England, the last part of July. The following provisional program has been arranged for the section on ophthalmology: July 25: "Headaches," discussion to be opened by Mr. A. D. Griffith (ophthalmology) and Dr. Wilfred J. Harris (neurology), followed by Dr. C. C. Worster-Drought, (general medicine) and Mr. Maurice Sorsby (otolaryngology). "Migraine," by Mr. T. W. Letchworth. July 26: "A Case of Blindness After Administration of a Brand of Neoarsphenamine," by Mr. F. A. Juler. "The Technique of Advancement and Tendon Lengthening in Strabismus Operations," by Mr. W. B. Inglis Pollock. "Local Ultraviolet Therapy in Eye Disease," by Mr. Frank W. Law. "Orthoptic Treatment of Squint: Its Scope and Limitations," by Miss Muriel A. Pugh. "Physics in the Problems of Ophthalmology," by Mr. Frederick T. Ridley. "The Dystrophies and Degenerations of the Macula," by Mr. Arnold Sorsby.

North Dakota Academy of Ophthalmology and Oto-Laryngology.—The academy held its annual meeting at Fargo on May 28, under the presidency of Dr. H. O. Ruud. Dr. W. R. Winn was elected president for the current year, and Dr. F. L. Wicks secretary.

UNIVERSITY NEWS

The Department of Ophthalmology of the University of Rochester School of Medicine and Dentistry will conduct its fifth annual summer graduate course of lectures and demonstrations in ophthalmology during a period of five days, beginning July 30 and ending August 3. The course will be limited to fifty members and will cover ophthalmic sur-

gery, ophthalmoscopy and medical ophthalmology, perimetry and ophthalmic neurology, slit-lamp microscopy, ophthalmic myology, pathology, retinoscopy and refraction. The lectures will be conducted before the group assembled as a whole, but for clinical instruction the group will be divided into small sections. The tuition fee for the course is $40. Of this amount, $15 is payable with registration, and the remainder on the first day of the course. Checks should be drawn to the order of John F. Gipner, M.D., and mailed to him at the Strong Memorial Hospital, Rochester, N. Y.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Aqueous Humor

THE AQUEOUS AND THE LENS METABOLISM: III. THE IODINE-REDUCING SUBSTANCES IN THE AQUEOUS AND THEIR RELATION TO THE LENS METABOLISM. H. MÜLLER, Arch. f. Augenh. **108:** 64, 1933.

Müller found that the aqueous when acid and free from protein has a considerable iodine-binding power. Blood serum does not have this property, and the cerebrospinal fluid and vitreous have it to a much lesser degree. The iodine-reducing substances of the aqueous are very sensitive to acid when in an alkaline medium, whereas when in an acid medium they retain their reducing properties for a much longer time.

He found only traces of iodine-reducing substances in aphacic eyes, from which he concludes that these substances in the reduced form are produced chiefly through the metabolism of the lens.

After naphthalene has been given by mouth the reducing power of the aqueous for iodine vanishes, and in ox eyes which had cataracts the reducing power of the aqueous for iodine was considerably diminished.

Müller, therefore, believes that in the aqueous there exists a reduction system which shows characteristic changes whenever the lens metabolism is disturbed (poisoning with naphthalene and complicated cataracts). The metabolism of the lens and this aqueous reduction system must be closely related. Further studies of the aqueous reduction system indicate that it is formed by vitamin C.

F. H. ADLER.

Conjunctiva

REPORT OF A SYPHILITIC DISEASE OF THE CONJUNCTIVA. F. VON PAPOLCZY, Arch. f. Augenh. **108:** 334, 1933.

In a previous communication (*Arch. f. Augenh.* **103:** 323, 1930) von Papolczy described a diffuse thickening of the conjunctiva in a 20 year old girl who had a strongly positive Wassermann reaction. The conditon cleared up rapidly under appropriate antisyphilitic treatment, and was therefore believed to be syphilitic.

In the present article two conditions are described which were quite unlike in their clinical appearance, but which occurred in patients with strongly positive Wassermann reactions and which disappeared under antisyphilitic treatment.

A 39 year old man who had acquired syphilis four months previously showed a uniform thickening of the bulbar conjunctiva, which invaded the limbus at the upper pole. The epithelium was intact, and the mass had a gelatinous appearance and was richly vascularized.

A 61 year old man who had acquired syphilis twenty-three years previously, but who still had a positive Wassermann reaction, presented

a bilateral swelling of the lower lids, with thickening so marked that there was definite ectropion. The tissue of the lids was extremely hard. Excision of some of this tissue showed nothing pathognomonic of syphilis.

In both cases the lesions healed rapidly after intensive antisyphilitic therapy.

F. H. ADLER.

FUNCTIONAL STUDY OF THE VEGETATIVE NERVOUS SYSTEM IN CASES OF SPRING CATARRH. T. TAKAHASHI, Acta soc. ophth. jap. **37**: 13 (Feb.) 1933.

The course and the treatment of vernal catarrh are still unsettled. Italian investigators have regarded the condition as being only a part of a general disease characterized by increased tone of the vegetative nervous system and particularly of the parasympathetic nerves, and have employed a preparation of epinephrine as being a stimulus to the sympathetic nerve. Takahashi has investigated five cases in which typical symptoms of spring catarrh were presented but no signs that could be regarded as being produced by vagotonia, though the general condition showed an unusual increase of tone of the vegetative nervous system. Eosinophilic leukocytes were found in the blood in only three of the cases and calcium in the blood in five. Examination of the vegetative nervous system showed occasional symptoms of vagotonia, while pharmacologic investigations spoke for both vagotonia and sympathicotonia. This is difficult to reconcile with the theory of the increased tone of the parasympathetic nerves. The calcium content in the blood is of no particular importance for the development of this condition. If calcium is used as a remedy it should be employed only in persons who have a reduced amount of calcium, for otherwise it is apt to be injurious. Takahashi believes that the etiologic feature of spring catarrh is to be found in the abnormal increase in tone of the vegetative nervous system. That it is a part of a general parasympathetic nerve disturbance is, however, not proved. Therefore, the use of epinephrine in the treatment of spring catarrh is not important.

A. KNAPP.

A HISTOLOGIC EXAMINATION OF THE CONJUNCTIVA IN GONORRHEAL CONJUNCTIVITIS. C. HAMADA, Acta soc. ophth. jap. **37**: 36 (April) 1933.

Hamada attempted to study the relation of the gonococcus to the conjunctiva in gonorrheal conjunctivitis by means of various staining methods, using Giemsa's solution and differentiation with methyl alcohol. Thirteen pieces of conjunctiva were examined, and the following conditions were found. In the conjunctiva of the eyeball gonococci were observed in large flakes on the surface of the epithelial layers where the surface had partly broken down, and between the epithelial cells in the superficial layers. Where the epithelium in its entire thickness had been lost no gonococci were found. In the conjunctiva of the eyelids and fornix, where the epithelium was frequently lost, there was a pseudomembrane of leukocytes, and the gonococci were found between this and what was left of the epithelial cells. Hamada believes that the

gonococci have a close relationship with the epithelial cells; that they are stuck to the surface of the protoplasm of the epithelial cells, and that the subepithelial gonococci which were found free in the tissue by Waldstein are very unusual.

A KNAPP.

Comparative Ophthalmology

ROENTGEN DEMONSTRATION OF SCHLEMM'S CANAL IN THE EYE OF A RABBIT. R. OKAJIMA, Acta soc. ophth. jap. **36:** 55 (June) 1932.

Okajima injected thorium dioxide sol into the anterior chamber of a rabbit's eye. The x-ray picture then showed two rings parallel to the limbus with numerous intervening canals connecting the two rings. The inner ring was believed to be Fontana's space, while the outer ring was Schlemm's canal, and the intervening canals were lymph vessels. The microscopic examination confirmed this, and suggested that Schlemm's canal belongs to the lymph vessels. Thorium dioxide sol was also injected into the living eye with the same results. The canals to the outer side of Schlemm's which connected with the anterior ciliary veins did not show in the picture.

A. KNAPP.

Congenital Anomalies

A CONJUNCTIVAL BAND SIMULATING A PERSISTENT NICTITATING MEMBRANE. C. V. KRISHNASWAMI, Brit. J. Ophth. **17:** 417 (July) 1933.

The patient presented a fold of the inferior fornix drawn up and adherent to a small area of the upper tarsal conjunctiva. It was blush pink and fan-shaped with the apex at the attachment to the upper tarsal conjunctiva and the base at the inferior fornix, the borders being crescentic. A few blood vessels ran vertically on its surface like the ribs of a fan. Apart from its location on the outer side of the cornea, it simulated a persistent nictitating membrane. The eyeball was perfectly free underneath the band. The author has seen four other similar cases.

The article is illustrated.

W. ZENTMAYER.

Cornea and Sclera

UNUSUAL ULCERS OF THE CORNEA AND THEIR TREATMENT. A. FUCHS, Brit. J. Ophth. **17:** 193 (April) 1933.

One case of an unusual type of keratomycosis, termed fascicularis because of its similarity to keratitis fascicularis of eczematous origin, is described. Simple removal of the mycotic concretion brought about complete healing of the lesion.

A case of ulcus maranticum in a woman, aged 73, who had been under treatment elsewhere for five weeks, is also described. The patient was greatly debilitated. There had been repeated purulent infiltration of the loss of substance with imminent intra-ocular extension of the infection along the incarcerated vitreous. As the cornea was dry, it is suggested that through lack of lysozym the pathogenic bacteria gained virulence. The patient died before complete healing of the ulcer was effected.

In the treatment of rodent ulcer, of which two cases are reported, the author favors repeated punctures of the anterior chamber.

In the treatment of keratitis dendritica, the staining portions as well as the thickened epithelial margins, after removal, are touched with a fine-pointed copper sulphate stick—a treatment advocated by E. Fuchs.

In severe cases, after other methods have failed, trephining in the densest infiltration, after the method of Sondermann, is advised. The article is illustrated.

W. ZENTMAYER.

"WHITE RINGS" IN THE CORNEA. A. J. BALLANTYNE, Brit. J. Ophth. 17: 336 (June) 1933.

Notes are given on six cases in which "white rings" in the cornea were shown. All but one of the cases occurred in males. The condition seems to have been described first by Coates, who reported two cases in 1912 and an additional case in 1913, as seen with the loupe.

Ballantyne reports that in the first of the six cases the right eye presented two "white rings." One near the center of the cornea was of irregular elliptic form, the long axis of the ellipse (nearly vertical) being about 0.5 mm. and the short axis about 0.25 mm. There was a short projection from the temporal side. The whole opacity was made up of numerous chalky-white globules and various-sized specks. The center of the ring was only relatively clear, for in it were scattered a number of very fine specks. Rather more than midway from the center to the lower border of the cornea there was a second, incomplete, ring made up of more or less confluent white dots. The diameter of this ring was about 0.12 mm.

In the other cases the corneal condition resembled, in general, that just described.

No histologic examination of the condition was made. It seems possible that the spots which compose the "white rings" arise from a degenerative change, calcareous or otherwise, situated on the surface of Bowman's membrane.

The cause of such rings is obscure. The assumption that the rings are of traumatic origin has no direct evidence to support it. Based on the findings, one would be justified in tracing these opacities to an intra-ocular disease; for in one case there was a chronic type of retino-choroiditis, and in another there was acute glaucoma, conceivably secondary to a uveal inflammation.

The article is illustrated and contains a bibliography.

W. ZENTMAYER.

"WHITE RINGS" IN THE CORNEA. M. S. MAYOU, Brit. J. Ophth. 17: 342 (June) 1933.

Mayou gives notes on a case of "white rings" to supplement the report of Ballantyne.

A man, 50 years of age, had mild keratitis profunda. There were no precipitates on Descemet's membrane. The biomicroscope showed on the lower inner sector of the cornea a ring of white dots, situated immediately beneath the epithelium, which was perfectly smooth over it. The dots were discrete, sharply defined and brilliant white. They had no connection with the interstitial opacity in the deeper layers of the cornea.

The author inclines to the view of Coates that the condition may be congenital. Illustrations are included. W. ZENTMAYER.

STRIATED SUPERFICIAL HERPETIC KERATITIS: REPORT OF CASES. ROLF SCHMIDT, Klin. Monatsbl. f. Augenh. **91:** 47 (July) 1933.

An epidemic of corneal herpes was observed and treated at Löhlein's ophthalmic clinic of Freiburg, Germany, in 1932. Catarrhal or febrile diseases were present only in 20 per cent of the patients. Superficial punctate keratitis predominated; the dendritic and disciform types were observed, and in two patients the transition from the superficial punctate to the disciform type could be observed.

The superficial striated variation of keratitis developed in four cases, which are reported and illustrated by five pictures. The striation consisted of parallel or crossing lines, which were composed of minute dots which stained with fluorescein, and were limited to the epithelium. The sensitivity of the cornea was reduced; pain was present at the onset and when recurrences occurred. Other symptoms completed the herpetic nature of this striated keratitis. It was temporarily accompanied by superficial punctate keratitis in three cases. Scrapings of the diseased cornea from the third case, inoculated into the cornea of a rabbit, produced the same eruption. Filaments developed on the epithelium of the cornea in two cases. In one of these, furthermore, there was hemorrhagic iritis, termed "herpetic" by Gilbert and other writers. These observations lead Schmidt to believe that many of the related cases, described by Caspar, Haab, Spicer and Greeves, belong to the same category. Herpes of the cornea is not of trophoneurotic origin, but is caused by a specific virus. No explanation can be given whether mechanical, chemotactic or nervous influences are responsible for the striated arrangement. Lattice-shaped keratitis has nothing in common with the striated herpetic keratitis. K. L. STOLL.

A CASE OF PROGRESSIVE SCLEROPERIKERATITIS (VON SZILY). T. NEMOTO, Acta soc. ophth. jap. **36:** 73 (July) 1932.

A man, 35 years of age, had been suffering from an annular opacity in the periphery of the cornea for eight years. It had shown very little change. General examination revealed a cutaneous tuberculid of the skin of the back. The right eye presented a dirty brownish discoloration of the bulbar conjunctiva around the cornea and an area of scleral redness at the temporal margin. In the periphery of the cornea there was an annular opacity which extended into the sclera. This opacity was superficially placed with newly formed blood vessels in the cornea. The opacity was sharply defined, and at its margins there were several small nodular infiltrations. The vision was 1.2 in each eye. The Wassermann reaction was positive. Tbe reaction to tuberculin was positive. Nemoto assumes that the condition was tuberculous.

A. KNAPP.

Experimental Pathology

THE EFFECTS OF DIET ON THE NATURE OF THE OCULAR LESIONS PRODUCED BY NAPHTHALENE. M. C. BOURNE, Brit. J. Ophth. 17: 210 (April) 1933.

The author summarizes the results of experimental work as follows: The type of ocular lesions produced in rabbits by naphthalene was found to depend on the diet.

In animals feeding on oats and cabbage, crystals are laid down on the retina; retinal exudates sometimes appear, but are limited in extent and never become confluent; the lens is either completely protected, or, if affected, the changes do not advance beyond the stage of early peripheral striae. The protective effect is believed to be due to the cabbage.

On diets of bran and carrots, or of oats, bran and carrots, extensive retinal exudates and changes in the lens leading to complete cataract are produced. Retinal crystals were never observed with this diet. In a few cases there was rapid death of the animal without the occurrence of any lesion except a slight swelling and haziness of the lens.

The toxic effects of naphthalene, in the absence of cabbage, are described, and the results of postmortem examinations are given. The optimum conditions for the production of cataract by naphthalene are suggested. A bibliography is appended. W. ZENTMAYER.

EXPERIMENTAL PROOF FOR THE ORIGIN OF MYOPIA. G. LEVINSOHN, Klin. Monatsbl. f. Augenh. **90: 504** (April) 1933.

Tamura furnished exact proof that spontaneous myopia occurs rarely in monkeys, i. e., in about 20 per cent. On the other hand, artificial myopia is readily produced in monkeys. Synchronous with the beginning of artificial myopia an atrophy of the pigmentary epithelium and of the choroid can be noted at the temporal margin of the disk; this is the essential anatomic substratum necessary for the development of the conus.

Contrary to Tamura's observations Levinsohn's findings indicate that the flattening of the temporal scleral margin of the disk, the retraction of the elastic membrane and the development of a well outlined loop of optic nerve fibers are artefacts. Levinsohn rejects Tamura's view that the experimental myopia of the monkey is due to increased intra-ocular tension. K. L. STOLL.

General

AUTOMATIC REGULATION OF HEATING IN ELECTRICAL HOT AIR STERILIZATION OF SURGICAL EYE INSTRUMENTS AND SILKS FOR SUTURE. S. HOLTH, Brit. J. Ophth. **17: 402** (July) 1933.

The author gives a short account of the development of sterilization of ophthalmic instruments by dry hot air and describes a recent model of an electrically heated, dry air sterilizer with contact thermometer and mercurial relay insuring automatic thermoregulation. The hope is

expressed that this addition to the sure, French dry air sterilization may contribute a well merited further use of this method, both by the general surgeon and by ophthalmic operators, especially for the latter, as the sharp point and edge of instruments are of the highest importance. The article is illustrated.

W. ZENTMAYER.

General Diseases

UNILATERAL CHOKED DISK DUE TO CHRONIC TONSILLAR INFECTION. G. WILSON and W. F. DARKES, J. A. M. A. **100**: 1233 (April 22) 1933.

Two cases are reported in which the author considers optic neuritis to have been due clearly to infection of the tonsils.

The removal of the tonsils, in both cases badly diseased, produced prompt improvement and a return in a relatively short time to normal vision and a normal state of the involved nerve.

If swelling of one or both optic nerves is the only physical sign present, and if the patient does not have headache or other symptoms suggestive of a tumor of the brain, he should not be rushed into submitting to encephalography, ventriculography or a decompression operation.

Cases of the kind reported have probably helped to swell the number of cases referred to naively by the neurosurgeons as instances of "pseudotumor."

W. ZENTMAYER.

OCULAR TUBERCULOSIS. J. GOMEZ-MARQUEZ, Arch. de oftal. hispano-am. **32**: 66 (Dec.) 1932.

Reference is made to modern developments in the knowledge of the multiple morphologic differentiation of the tubercle bacillus and of the lesions which it produces. In contrast to Koch, Villemin and Laënnec, with their primitive unitarian points of view of the etiology, manner of infection and pathology of tuberculosis, Gomez-Marquez divides tuberculous ocular lesions into three groups: (1) external tuberculous ocular lesions, in which the bacillus can be demonstrated; (2) intra-ocular tuberculous lesions, in which the diagnosis must be made by exclusion; (3) nontuberculous lesions due to an allergic hypersensitivity arising from tuberculous infection. Each group is described in great detail.

As regards treatment, the first group of lesions are for the most part amenable to medical treatment, being largely treated surgically. In the second group of lesions, which often heal spontaneously, when a progressive tendency is noticeable he considers that tuberculin and sanocrysin are indicated. The latter is free from the dangers attendant on tuberculin and does not require the double care of an internist and an ophthalmologist. He employs it intravenously, commencing with 0.05 Gm. doses and gradually increasing these to 0.25 Gm., the total amount being from 4.5 to 5.5 Gm. The series of injections rarely requires to be repeated. In treating the third group a great many local and general measures are of use; among others he stresses the value of Spengler's immunizing bodies.

C. E. FINLAY.

CHLOROSIS WITH BILATERAL CHOKED DISK, STAR-SHAPED FIGURE IN THE MACULA AND PARALYSIS OF THE LEFT ABDUCENS. K. OHASHI, Acta soc. ophth. jap. **36:** 111 (Sept.) 1932.

In 1879 Bitsch reported for the first time on the ocular complications of chlorosis, and a number of articles have since appeared on this subject. Ohashi reports the case of a girl, 19 years of age. After suffering from headache, rigidity of the neck and vomiting she noted a reduction of vision in both eyes and diplopia. Five weeks later bilateral choked disk was present, with a star-shaped figure in the macular region, paralysis of the left abducens and a central scotoma in each eye. There was no pulsation of the retinal vessels or hemorrhages. On lumbar puncture the spinal fluid was found under pressure, and this procedure was followed by an improvement of vision. Three months later the other clinical symptoms had all disappeared, except for a whitish discoloration of both disks. The author believes that all of these symptoms were secondary to a serous meningitis; the star-shaped figure in the macular region was the result of retinal edema with fatty degeneration.

A. KNAPP.

General Pathology

THE INVOLVEMENT OF THE VITREOUS AND LENS IN CERTAIN DISEASES OF THE EYE. T. OKUCHI, Acta soc. ophth. jap. **36:** 115 (Sept.) 1932.

1. Vitreous opacities are regularly found with the slit lamp in cases of muscae volitantes.

2. Vitreous opacities are found in association with all diseases of the eyegrounds except disease of the optic nerve, such as axial neuritis.

3. Retinitis pigmentosa and detachment of the retina are frequent causes of complicated cataract. Complicated cataract occurs in 100 per cent of cases of retinitis pigmentosa in the late stages.

4. If myopia is greater than 4 diopters vitreous opacities can frequently be observed with the slit lamp, and they are always present when myopia is greater than 7 diopters. The vitreous opacities are present in proportion to the degree of the myopia. Complicated cataract is observed in myopia greater than 9 diopters.

5. Frequently, after removal or luxation of a lens, pigment deposits are observed in the vitreous fibers.

A. KNAPP.

Glaucoma

LATER RESULTS OF POSTERIOR SCLERAL TREPHINING IN GLAUCOMA SECONDARY TO IRIS BLOCK. A. NICOLATE, Arch. di ottal. **40:** 359 (July-Aug.) 1933.

The author describes a modification of his technic previously described by which the conjunctival incision is removed from the scleral opening, which is 5 mm. behind the limbus. This prevents adhesion of the wound to the lips of the scleral wound and makes for more permanent reduction of tension. The procedure is especially successful when high tension has persisted for a considerable time, so that the vitreous is degenerated and fluid, its object being to preserve certain globes otherwise destined for enucleation. The fluid which forms under

the conjunctiva is removed by syringe several times in the first few weeks after operation. The operation was performed in twelve suitable cases within the last three years, with tension varying from 55 to 96 mm. In all but one of these cases the tension has remained much reduced, and the scleral wound has maintained filtration. It has not been necessary to enucleate any of these eyes, and only one in the series previously reported on has been enucleated. S. R. GIFFORD.

THE FUNCTIONAL DISTURBANCE OF THE SYMPATHETIC NERVE IN GLAUCOMA WITH NAEVUS FLAMMEUS. N. IMAI, Acta soc. ophth. jap. **36:** 114 (Sept.) 1932.

In two cases of simple glaucoma with nevus of the same side of the face, Imai examined the condition of the sympathetic nerve of the head. The instillation of epinephrine hydrochloride into the conjunctival sac in the first case caused no dilatation of the pupil on the affected side, but on the healthy side the pupil dilated after twenty minutes. The pupils in the second case dilated moderately after instillation of epinephrine hydrochloride, but the dilatation was less marked in the glaucomatous eye than in the healthy eye. The albuminous content of the second aqueous of the diseased eye was found to be increased to double that of the first aqueous, while on the healthy side there was no difference between the first and the second aqueous. He concludes that the cause of glaucoma with nevus on the same side of the face is to be found in a functional disturbance of the sympathetic nerve of the head.

A. KNAPP.

Lens

THE PLATINUM POTENTIAL OF THE LENS IN CATARACT. J. NORDMANN and P. REISS, Compt. rend. Soc. de biol. **114:** 12, 1933.

With the platinum electrode introduced into the normal lens of the living rabbit, the reading averaged +93 mV (millivolts). In naphthalene cataract the potential was + 150 to + 176 mV, and in massage cataract, + 164 to + 168 mV. In the dog, the potential of the normal lens was +89 mV, and in senile cataract, +176 mV.

In man, by means of a discission knife of platino-iridium with a bakelite handle, the potential of various types of cataract was measured. The readings were + 163 to + 167 mV. In every case of cataract throughout the potential was considerably augmented. Since the potential is an index of oxidoreduction factors, this observation corresponds to the chemical findings of changes in composition in cataract with associated diminished reduction power. J. E. LEBENSOHN.

CAPSULAR AND PYRAMIDAL OPACITY OF THE LENS. E. NISTA, Ann. di ottal. e clin. ocul. **61:** 425 (June) 1933.

Nista studied material from three cases histologically. One was that of a typical pyramidal or anterior polar cataract, the result of a perforating ulcer soon after birth. The part nearest the apex was lamellar in structure and showed granules of pigment on its surface, indicating previous adhesion to the iris at this point. The basal part

of the pyramid was more lamellar in structure. A homogeneous membrane, continuous with the capsule of the lens, surrounded the opacity completely, thus excluding the possibility that mesodermal elements could have entered the capsule to form the opacity. The capsular epithelium, however, stopped at the borders of the opacity. The opacity is considered as formed by abnormal proliferation of the elements of the lens, due to pressure on the cornea and perhaps also to toxins from the infectious agent causing the ulcer.

The second case was one of circumscribed subcapsular opacity occuring in senile cataract. No signs of concretions of the capsule of the lens were found, and the opacity is attributed to degeneration of the capsular epithelium. The capsule of the lens was intact over the mass of hyalinized fibrils containing many lacunae. The third case was of similar nature, and in both the latter cases the structure of the opacity differed completely from that of true pyramidal cataract. An extensive discussion of previous literature, with a bibliography, is included.

S. R. GIFFORD.

THE DOUBLE REFRACTION OF THE LENS. OSCAR LENHARD, Arch. f. Augenh. **108:** 1, 1933.

By a complicated method of polarization microscopy Lenhard finds that the double refraction of the lens proves a radial arrangement of its rodlike anisotropic micelles. The double refraction of the chicken lens is characteristically different from that of the mammalian lens. The radial arrangement of the micelles develops in the embryo and is due to the tension of the capsule and the lens fibers, whereas their other pecularities may be due to the influence of accommodation.

F. H. ADLER.

Neurology

SPASM OF THE FACE AND LIDS IN THE POSTERIOR CERVICAL SYMPATHETIC SYNDROME. J. EUZIÈRE, H. VIALLEFONT, R. CASTAGNE and R. LAFON, Arch. Soc. d. sc. méd. et biol. de Montpellier **14:** 31, 1933.

Six cases are reported in which rheumatism of the cervical vertebrae was associated with spasm of the face and lids. It is suggested that the syndrome is due to irritation of the vertebral sympathetic trunk and consequent ischemia of the facial nerve. Other symptoms that may be associated with the syndrome are disturbances in trigeminal sensibility, headache, vertigo, hyperacusis, tinnitus, tingling in the pharynx and pain on deglutition, and these symptoms are probably similarly produced.

J. E. LEBENSOHN.

BILATERAL BLEPHAROSPASM OF ENCEPHALITIC ORIGIN. J. EUZIÈRE, H. VIALLEFONT, J. VIDAL, RAUX and J. ZAKHAJM, Arch. Soc. d. sc. méd. et biol. de Montpellier **14:** 122, 1933.

Blepharospasm in epidemic encephalitis is thoroughly discussed. In the case reported, bilateral blepharospasm was associated with a concomitant spastic torticollis. The general view is that dark glasses have a calming influence.

J. E. LEBENSOHN.

Ocular Muscles

SQUINT AMBLYOPIA. R. HESSE, Arch. f. Ophth. **130:** 375 (Aug.) 1933.

In a previous article (*Arch. f. Ophth.* **128:** 145, 1932) the author discussed the relation between horizontal excursion (abduction and adduction) and the angle of squint. He now reviews the same material, with special reference to the presence or absence of amblyopia. In the cases of alternating squint no amblyopia was found. In the majority of the cases the visual acuity and the optical conditions were approximately the same in both eyes. Forty per cent of the 185 cases of constant unilateral strabismus showed definite objective reasons (corneal scars, unilateral hyperopic astigmatism, unilateral high degree hyperopia, unilateral high degree myopia, complicated cataract, choroiditis, congenital anomalies) for the poor vision of the squinting eye. The remaining 60 per cent of the cases of constant unilateral strabismus included the cases of squint amblyopia without definite objective reason (amblyopia ex anopsia in the strict sense of the word), and the cases in which despite the constant unilateral strabismus no amblyopia had developed. The quantitative relation between those two groups varied, depending on the definition of amblyopia. This study again brought out the significant fact that some people, in spite of a unilateral constant strabismus of more than ten years' duration, do not have amblyopia. This fact suggests that anopsia is not the only determining factor in true squint amblyopia.

P. C. KRONFELD.

Operations

A MODIFICATION OF MY OPERATION FOR ENTROPION AND TRICHIASIS. D. LYRITZAS, Arch. f. Augenh. **108:** 339, 1933.

A new operation for the relief of entropion and trichiasis was reported by this author in the *Archiv für Augenheilkunde* (**97:** 36, 1925). Since that report the operation has been performed in a number of cases in which the degree of the entropion was too great to be permanently overcome by the method as first described. For this reason the author has revised the operation somewhat and reports it in this paper as follows:

1. Local anesthesia is obtained with a 1 per cent solution of cocaine and epinephrine by infiltration. A horn plate is inserted at the upper tarsal margin of the upper lid on the skin surface and the lid rolled, exposing the conjunctiva covering the tarsus. A cut is now made with the scalpel about parallel with the upper edge of the tarsus and almost the entire length of the tarsal plate, through the conjunctiva and through the tarsus. A second cut is made extending from one end of the first cut to the other end, but paralleling the lower edge of the tarsal plate, i. e., the lid margin. These two cuts isolate an island of conjunctiva and tarsus, which is now cut away with scissors.

2. The upper lid is now turned back into its natural position, and the horn plate is inserted between the eyeball and the lid. A cut is now made in the skin surface close to the lid margin and following the same from one side to the other. A second cut is then made from 2 to 3 mm. above the first cut and parallel to it. [In the illustration

given, this cut is not parallel to the first cut, but merely joins its two ends. Abstractor]. The piece of lid so outlined is then excised with scissors.

3. Five stitches are now inserted close to the cilia, then through the muscle and through the superficial layers of the upper section of the tarsus, and these are brought out at the upper edge of the skin wound. The stitches are then tied, which brings the lid into its natural position or into one slightly overcorrected. The stitches are removed at the end of a week.

F. H. ADLER.

TOTAL CORNEAL TRANSPLANTATION. V. P. FILATOFF, Sovet. vestnik oftal. 2: 217, 1933.

This total transplantation of the cornea is reported by Filatoff in detail because of the numerous technical difficulties encountered during the operation. A patient, aged 56, had absolute glaucoma of the right eye, with no perception of light, deep cupping of the optic disk and a transparent cornea. On the left eye there was a total staphyloma with faulty projection of light. The tension was 57 mm. For the avoidance of postoperative glaucoma because of the absence of the anterior chamber in the staphylomatous eye Filatoff thought it advisable to transplant together with the cornea also the iris and the ciliary body so that an anterior chamber with its angle for the outflow of the aqueous could form after the healing of the transplant.

The right eye was enucleated, and the cornea with a scleral and conjunctival strip from 5 to 6 mm. wide was resected. The iris was preserved completely and only the anterior part of the ciliary body was preserved with the scleral strip. The lens was removed, the transplant, lying on the vitreous, was put into a Petri dish. On the host eye (left) the conjunctiva was undermined around the limbus. The sclera was cut obliquely 5 mm. from the limbus. For the purpose of preventing prolapse of the vitreous Filatoff put a strong, continuous suture through the base of the staphyloma, which he then resected in front of the suture. The cataractous lens was extracted, the staphyloma sutures were tightened immediately so that hardly any vitreous escaped, and the staphyloma was flattened considerably. The sclera of the transplant was united with the host sclera by catgut sutures. The staphyloma suture was then cut and a pupil 3 mm. wide formed under the transplant. The transplant was covered with the conjunctiva; the lids were sutured. During the first dressing the cornea was clear, the iris was seen, the anterior chamber was present and there was a partial hyphemia. In two weeks the tension increased, the cornea became cloudy, and a paracentesis was done.

Eight months after the operation the eye was in the following condition: The shape of the cornea was a vertical oval; its luster was present; there was no sensitivity of the cornea. The cornea was opaque in the deep layers, the opacity being denser in the center. Numerous branching blood vessels were invading the periphery of the cornea from the limbus. The iris was seen with engorged blood vessels in it. The pupil, 2½ mm. wide, was covered with a yellowish-gray membrane, with a small clear space in the upper part. The anterior chamber was

present and deep, and tension of the eye was normal. The line of adhesion of the transplant to the host sclera was pigmented. The projection of light was good; the visual acuity permitted finger-counting at one third of a meter eccentrically.

Filatoff believes that his first object, to avoid postoperative glaucoma, was fulfilled, as the angle of the anterior chamber was functioning and the tension remained normal. The transplantation of the cornea with the iris and the angle of the anterior chamber is therefore worth considering. A larger strip of sclera should be taken in order to avoid injury of the ciliary body as happened in his case. The prevention of prolapse of the vitreous was obtained by tightening the continuous suture through the base of the staphyloma immediately after the resection of the staphyloma.

O. SITCHEVSKA.

Orbit, Eyeball and Accessory Sinuses

RETROGRESSION OF EXOPHTHALMOS AFTER OVARIAN THERAPY. L. HALPERN, Med. Klin. **29:** 808 (June 9) 1933.

Halpern reports the history of a girl, aged 21, who eight months previously presented exophthalmos on the right side. An enlargement of the thyroid was not noticeable, and the basal metabolism was normal. There was, however, at times a slight tachycardia, and the fingers showed a slight tremor. There were no signs of a local etiology of the exophthalmos. The history revealed that the menstruation, although regular, was of short duration and that the flow was scanty. Libido was entirely absent. The genitalia were somewhat hypoplastic. The assumption of a correlative regulation of the incretory organs and the ovarian insufficiency (scanty menstruation, hypoplastic genitalia, lack of libido) induced the author to try ovarian therapy. The patient was given desiccated ovarian substance three times daily. After three weeks a considerable improvement of the exophthalmos was noticeable, and the menstruation that set in during the third week of the ovarian treatment was more profuse and lasted longer. After the exophthalmos had largely disappeared, an attempt was made to discontinue the ovarian therapy, but the protrusion of the eye returned. After five weeks the exophthalmos had completely disappeared.

[J. A. M. A.]

INTERMITTENT EXOPHTHALMOS. B. KIRA, Acta soc. ophth. jap. **36:** 122 (Oct.) 1932.

This condition was observed in a woman 32 years of age. In the upright position there was an enophthalmos of 5 mm. of the right eye. On holding the head forward for 45 seconds the right eye protruded 7 mm. and remained in protrusion for hours. There was some lack of development of the right half of the face. The patient also suffered from venous ectasia in the right side of her neck and in the region of her left elbow. With the onset of the exophthalmos a varicose swelling could be observed in the inner angle of the orbit. Kira believes that this condition was due to varices of the orbital veins with secondary atrophy of the orbital fat from pressure.

A. KNAPP.

MUCOCELE OF THE MAXILLARY SINUS. M. TAKANO, Acta soc. ophth. jap. 37: 15 (Feb.) 1933.

The usual mucoceles of the nasal sinuses generally involve either the frontal or the ethmoid sinuses. The mucocele of the maxillary sinus destroys the wall of the orbit and disturbs the eye. The author presents a case. A man, 59 years of age, showed a swelling of the lower lid and pressure on the right eye. These had existed for a number of months. The eyeball was deviated upward. At operation it was found that the protrusion was caused by a mucocele of the maxillary sinus which had perforated the orbital wall. The mucocele contained cloudy fluid of a tenacious, yellowish-brown character. Histologic examination of the wall of the cyst showed a chronic inflammation. It is believed that the process started with an empyema confined to the antrum, with walls atrophied from pressure, and that then the cystic protrusion developed.

A. KNAPP.

Physiology

EFFECT OF SHORT WAVE LIGHT RAYS ON THE RETINA OF THE RABBIT. S. SHINDO, Acta soc. ophth. jap. 36: 25 (April) 1932.

Shindo has endeavored to study the action of rays of various wavelengths on the retina of the rabbit and concludes:

1. The ultraviolet rays from 310 to 380 millimicrons in wavelength produce no changes in the retinas of eyes with lenses.

2. The short-wave visible rays, from 380 to 433 millimicrons in wavelength, produce a degenerative change consisting of a destruction of the visual cells, hypertrophy of the glia, cavernous atrophy and accumulation of pigment scales in the outer retinal layer.

3. The long-wave visible rays, from 430 to 455 millimicrons in wavelength, do not produce so marked an effect.

4. Preliminary injection of epinephrine hydrochloride into the vitreous increases the destructive action of the rays but little; injection alone produces hardly any effect.

5. There can be no question that the injury of the retina with or without epinephrine sensibilization is caused by the short-wave visible rays, from 380 to 433 millimicrons in wavelength, and never by the ultraviolet rays.

6. It is believed that in man the exposure to daylight for many years of a retina sensitized from a suprarenal insufficiency may play a large rôle in the development of retinitis pigmentosa. A. KNAPP.

EXPERIMENTAL INVESTIGATION OF OCULAR PRESSURE AND ITS RELATION TO THE TONE OF THE VEGETATIVE SYSTEM. K. IMACHI, Acta soc. ophth. jap. 36: 79 (July) 1932.

Adamuck showed that the sympathetic nerves cause ocular pressure, so that it was hoped that a relationship between the vegetative nervous system and glaucoma could be established. There are, however, many unknown features in the physiology of the vegetative nervous system. One investigator believes that the tone of the vegetative nervous system throughout the body influences ocular pressure, as has been shown by

the general administration of various remedies and by pharmacodynamic investigations which have been made in patients with glaucoma. Others believe that a local influence on the eye has been demonstrated by the local application of certain agents and by the results of lesions of the cervical sympathetic nerve.

Imachi has studied the ocular pressure in rabbits manometrically after general and local applications of certain specific remedies such as the following: physostigmine sulphate, choline acetylchloride and pilocarpine hydrochloride, agents which excite the parasympathetic nervous system; atropine sulphate, which inhibits the parasympathetic nervous system; epinephrine hydrochloride, which excites the sympathetic nervous system; ergotoxine phosphate, which inhibits the sympathetic nervous system; hystamine; amyl nitrate; pituitary, and thyroglandol.

His conclusions are: After stimulation of the general parasympathetic nervous system there is a reduction in the ocular pressure, while on local application of the stimulant there is an increase in the pressure which then gradually sinks below what it was in the beginning. Inhibition of the general parasympathetic nervous system causes at first a drop in the ocular pressure, while after a local application of the inhibiting agent there is an elevation of the pressure, which then gradually returns to what it was originally. General stimulation of the sympathetic nervous system causes a marked increase in ocular pressure; local stimulation generally produces an elevation followed by a gradual sinking. General inhibition is followed by sinking of the ocular pressure, while local inhibition first induces a rise in pressure and then a sinking.

In short the influence of the vegetative nervous system on the ocular pressure is uncertain whether the action is general or local. The stimulation of one system does not always exert an action on the ocular pressure opposite to that of the inhibition of the same system, and not always an action similar to that of an inhibition of the other system.

A. KNAPP.

Refraction and Accommodation

OBSERVATIONS ON THE ACCOMMODATED LENS. C. KOCH and F. P. FISCHER, Arch. f. Augenh. **107**: 434, 1933.

The authors have attempted to bring some objective proof of Gullstrand's theory of the internal or intracapsular accommodation by observing the lenses of normal persons with the slit lamp in both the unaccommodated and the accommodated state. They argue that if the different portions of the lens change their shape in the characteristic way that Gullstrand thought they should on the basis of their isoindicial surfaces, then these changes in shape should be detected in the zones of discontinuity as they normally appear in the slit beam.

After dilating the pupil with a drug of low cycloplegic power (racemic ephedrine) they found that the surface of the adult nucleus became much more convex during accommodation and that the increase in curvature proceeded in the approximate form of a parabola. This surface also moved slightly forward toward the next separating zone of discontinuity. The deeper zones of discontinuity did not appear to change in shape or in position.

Further observations of the lens in polarized light also confirmed Gullstrand's hypothesis. The internal accommodation of the lens is essential for the change in dioptric strength of the lens. The physical structure of the lens makes this internal accommodation possible. The proof of the existence of internal accommodation affords further proof of the Helmholtz theory of accommodation, for this can take place, according to these authors, only if the zonule is relaxed during accommodation.

The internal accommodation is effective in that the increase in refractive power of the lens is increased by this mechanism more than can be accounted for by the change in curvature of the lens as a whole. The internal accommodation results in an increase in the total refractive index of the lens.

F. H. ADLER.

Retina and Optic Nerve

PERSONAL EXPERIENCE IN THE TREATMENT OF RETINAL DETACHMENT; A DESCRIPTION OF THE MORE RECENT OPERATIVE PROCEDURES. H. ARRUGA, Arch. de oftal. hispano-am. 32: 614 (Nov.) 1932.

Arruga first reports his results from four years of practicing the operative treatment for retinal detachment. He has observed 216 of these cases of retinal detachment. He excludes 13 of these from the report because of their secondary origin (intra-ocular tumor, uveitis, metastatic choroiditis and Hippel's disease). Of the remaining 203 cases he operated in 164, the others being cases in which the condition was inoperable or in which the patients refused operation. In one third of the 164 cases he obtained a cure, considering this to be a total reapplication of the detached retina; useful vision was not obtained in all the cases owing to complicating intra-ocular lesions. In 40 cases the final vision was 2/10 or better.

Relapses, he finds, are most apt to occur in the first three months. These are not real relapses but the results of incomplete operations, usually requiring repetition of the operative procedure (at times four, five, six and even seven times); in consequence he has performed 243 operations on his 164 patients. At first he could determine retinal tears in only about one half of his cases, but with greater experience he now finds them in 90 per cent. In many cases the tear was hidden among the retinal folds. They could not be located in 32 cases, which furnished the greater number of the failures. In 92 of the 132 cases in which the tear was localized, it was single; in the others, two, three or more tears were determined. Most of the tears were situated at the equator in the upper and outer quadrant; peripheric detachments were mostly found below and externally. He has seen only 5 macular detachments. The region between the macula and the equator is generally free from detachments.

Prognosis grows continually more precise. The favorable factors are: a recent occurrence, youth, a limitation of the lesion, absence of external or internal ocular reaction and a good general condition of the patient.

Operative Technic.—In his first cases he used Gonin's method with the thermocautery, later substituted by the galvanocautery. This

requires a precise localization of the tear, for which he recommends Wewe and Guist's apparatus. In this and in all operations for detachment he immobilizes the eyeball with a suture through the inferior rectus and the lower lid. Of late he has used the Lindner-Guist operation; it does not require such a precise localization of the tear. The operation is long and tedious. To avoid a suspension of the operation when the choroid is perforated in any of the early trephinings, he has devised a metallic obturator with which he temporarily closes the opening. In some cases he has substituted, with benefit, for potassium hydroxide a 5 per cent sodium hydroxide solution; this does not require neutralization with the acetic acid solution. After from fifteen to twenty seconds the solution is washed off. Of late, to avoid making the numerous trephine openings usually required, he has been injecting one-fourth drop of a 1 per cent sodium hydroxide solution in two directions between the choroid and the sclera. In a few cases he has combined the use of the galvanocautery with trephining. All of these methods based on the use of chemical caustics are productive of greater inflammatory reaction (which he describes and illustrates with colored plates) than follows the employment of the galvanocautery or the thermocautery.

He then describes the methods based on the use of diathermy and high frequency currents, as advocated by Larrson, Weve, Meller, Jess, Salus, Šafàř, Genet and Clausen, which he considers indicated in some cases but with which he has no personal experience in man.

Finally he details the Guist operation as practiced by him, referring also to Lindner's method of dealing with macular detachments through a scleral incision followed by a separation of the choroid from the sclera and a subchoroidal injection of 0.005 cc. of 6 per cent potassium hydroxide solution.

C. E. FINLAY.

CAROTIS INTERNA AND OPTIC NERVE. ADRIAN-MATSCHKE, Klin. Monatsbl. f. Augenh. **90:** 245 (Feb.) 1933.

Reports of only twenty cases of pathologic changes of the optic nerve caused by calcifications in the internal carotid and evidenced by roentgenograms have been published; ten of them were reported by Arnold Knapp. Adrian-Matschke adds a report of six cases, with stereoscopic roentgenograms made in a series of seventeen cases observed at the University Eye Clinic at Leipzig.

The optic nerve may suffer lesions by pressure (1) where the sclerosed ophthalmic artery enters the optic nerve in a longitudinal way, (2) at the termination of the fibrous channel and (3) in the middle between the channel and the chiasm, where the carotid may press the optic nerve against the anterior cerebral artery. The roentgenogram shows the calcifications in the internal carotid in the area of the middle cranial fossa, i. e., in the sella turcica, in the shape of one or two curved lines which correspond to the course of one or both carotids. Stereoscopic pictures are essential for the diagnosis, so as to avoid confusion with calcifications in the hypophysis or with changes in the sella.

In three of the author's cases the optic nerve showed marginal excavations as seen in glaucoma; tension was increased, and glaucoma was diagnosed. In two other cases the disks were normal. In the eyes of

the sixth patient the disks presented typical, not marginal, atrophic excavations. Marginal atrophic excavations such as those described by Thiel were not observed in these cases. Pathologic changes of the optic nerves may be absent, even if the roentgenograms show calcifications.

K. L. STOLL.

ALBUMINURIC RETINITIS IN A PATIENT WITH CLOSURE OF THE CENTRAL RETINAL ARTERY. H. KOTSUKA, Acta soc. ophth. jap. **36:** 54 (June) 1932.

This patient had suffered from a closure of the central retinal artery two years previously during parturition, and now suffered from the retinitis of pregnancy. The interesting feature was that the albuminuric retinitis developed only in the healthy eye; so apparently it is necessary to have a normal retinal circulation in order for albuminuric retinitis to develop.

A. KNAPP.

ANATOMIC EXAMINATION OF RETINAL DETACHMENT. T. TAKAMATSU, Acta soc. ophth. jap. **37:** 14 (Feb.) 1933.

The eye of a patient, 22 years of age, was examined on account of relapsing retinal detachment, which was healed for a time with thermocautery. Particularly interesting was a new formation of connective tissue fibers between the visual cells and the pigmentary epithelium, in other words, on the outer side of the retina. This may be in relation to retinitis striata, which results from the organization of a fibrin coagulum in the subretinal fluid in detachment. In this particular case the connective tissue resulted from a proliferation and emigration of the pigmented epithelial cells as the result of a tuberculous process. The case suggests the following mechanism of the retinal detachment. The retina is detached from the traction of new-formed connective tissue which is situated on the outer side of the retina just as in the retraction theory of Müller the shrinkage and traction occur in new-formed connective tissue on the vitreous side of the retina.

A. KNAPP.

ANGIOID STREAKS OF THE RETINA AND PSEUDOXANTHOMA ELASTICUM. T. MAYEDA, Acta soc. ophth. jap. **37:** 44 (April) 1933.

A man, 35 years of age, otherwise in good health, exhibited typical streaks of pigment in both eyegrounds with recent hemorrhages in the right eye. The hemorrhages were apparently situated between the pigmented epithelium and the choroid. In the left eye there was no hemorrhage. The cutaneous changes which go under the name of pseudoxanthoma elasticum were present. These are sometimes so mild that the patient knows nothing about them. Mayeda shares the view of Gronblad that in this condition there must be a general disturbance of the elastic substances in the body, which are particularly prevalent in the eye.

A KNAPP.

Trachoma

THE MICROBIOLOGIC ETIOLOGY OF TRACHOMA. MORAX, Rev. internat. du trachome **10:** 113 (July) 1933.

As reported at the Fourteenth International Congress on Ophthalmology at Madrid, the author brings together a wide variety of facts

and published papers from which evidence he concludes that the inclusion bodies of Prowazek found in trachoma are analogous to those inclusion bodies found in different types of conjunctivitis. This conclusion simply adds to the study of the complicated condition known as trachoma and does not shed any light on its possible bacteriologic nature.

L. L. MAYER.

Tumors

MELANOTIC SARCOMA DEVELOPING ON A PTERYGIUM. M. MARÍN AMAT, Ann. d'ocul. **169:** 885 (Nov.) 1932.

Sarcoma developing on a pterygium is very rare. The case reported is that of a man, aged 43, married, a stonecutter, who came under observation in May 1932, when he complained that he had a small internal pterygium in each eye, which had occasionally given him some discomfort. Four years previously he had been hit in the right eye with a small piece of stone which had inflamed the eye slightly for three or four days. About a year later a small dark point appeared in the pterygium of the eye that had been injured. This dark area increased gradually as a small excrescence that prevented proper closing of the lids. Examination showed the left eye to be normal except for the small pterygium. In the right eye one saw a large excrescence which occupied the internal angle between the lids and prevented their closure. With more minute examination and separation of the lids, one saw a large internal pterygium with a wide base which extended onto the cornea for about 1 mm. The dark color of the surface was confined to the central area; the periphery kept its characteristic red color. In the center of the pterygium there was seen this black tumor, cylindric in shape, which reposed between the lids. A clinical diagnosis was made—melanotic sarcomatous degeneration of a pterygium of the right eye. A piece was excised for microscopic examination and treatment with radium undertaken. Result: Complete cure of the neoplasm in situ and persistence of the normal pterygium tissue, which was not affected by the radium. The eye itself was not affected. There exists some doubt that perhaps metastasis in other parts will ultimately render ineffectual the marvelous results obtained with radium.

S. H. MCKEE.

HEMORRHAGIC TUMORS OF THE ORBIT. M. I. AVERBACH, Russk. arch. oftal. **8:** 808, 1932.

The conditions favoring orbital hemorrhages are discussed by Averbach at length and are grouped as follows: hemophilia, scurvy, general vasomotor disturbances, organic diseases of the walls of blood vessels, stasis with hypertension, and trauma. He adds to all the cases reported in the literature certain ones of his own in each group. He reports two cases of unilateral exophthalmos in which the condition was clinically diagnosed as orbital tumors but on the operating table proved to be hematoma. He purposely, therefore, omitted the usual term "cyst of the orbit" for such tumors. One of the patients gave the history of a gradual protruding of the right eyeball for seven years. Examination showed ptosis, exophthalmos and limitation of movements of the eye

upward. A soft, elastic tumor was palpated at the upper orbital wall. All tests and the roentgenogram failed to contribute any information of importance. A neoplasm was suspected. The patient was operated on, and his recovery was uneventful. The content of the tumor was a reddish-brown liquid. Under the microscope sections showed an abundance of round cells, infiltration and granulation tissue. There were numerous erythrocytes, hemosiderin, cholesterol, and a dark pigment that gave a positive reaction for iron. The second case resembled the first one in every respect. In both cases the wall of the cavity facing the orbit had its own fibrous membrane, while the wall facing the bone had no relation with the periosteum. The conclusion is drawn that in both cases a subperiosteal hemorrhage occurred in the upper orbital wall which after a long time underwent a series of complicated changes, partly of inflammatory, partly of degenerative or atrophic nature.

O. SITCHEVSKA.

THE DIAGNOSIS OF NEVI OF THE CONJUNCTIVA. E. T. BIONTOWSKAYA, Sovet. vestnik oftal. **2**: 88, 1933.

A man, aged 30, stated that he had had a brown spot on the left eye since childhood. The spot had increased in size considerably for the past two months. A pigmented nevus with an abundance of blood vessels encroaching on the cornea was present. A melanosarcoma was suspected, and the eye was enucleated. The pathologic examination showed a polymorphous character of growth. There were three definite groups of cells. One group resembled connective tissue cells; these were richly pigmented and accumulated near the blood vessels. The second group could be classified morphologically as endothelial cells. The third group, close to the cornea, resembled carcinomatous epithelial cells with little pigment and blood vessels. Biontowskaya analyses the main theories as to the origin of nevi; she believes that her microscopic observations of this neoplasm combined the evidence advanced for these theories. It is important to excise as much tissue as possible in order to find all three groups of cells and to make a correct diagnosis of the histogenesis of nevi.

O. SITCHEVSKA.

Vision

THE BINOCULAR VISION OF RELIEF. G. PACALIN, Arch. d'opht. **50**: 460 (July) 1933.

Pacalin discusses the part played by physiologic diplopia in vision of relief. He presents the subject by means of diagrams and experiments to be carried out by the reader. He has made use of Hering's theory of a single eye, which is once more verified, and has added support to it from facts derived from observations of physiologic diplopia. The means of acquiring stereoscopic vision without a stereoscope are open to anybody who will apply them. The habit once acquired, little mental effort is required to see relief instantly. This paper does not lend itself well to abstraction and is worth study in the original.

S. B. MARLOW.

EXPERIMENTAL RESEARCHES ON THE MINIMUM VISUAL ACUITY FOR AUTOMOBILE DRIVERS. C. SIMON, Arch. d'opht. **50:** 480 (July) 1933.

Because of the very different arbitrary standards of visual acuity required in different countries and proposed by various authors for drivers of automobiles, as shown by a table, Simon has tried to subject this question to experimental study. As a result he believes that the minimum acuity should be 1/3 with or without correction. This degree of acuity has to do with monocular vision. When the two eyes are considered, other factors enter into the problem which make the vision of the worse eye a not indifferent consideration. He estimates that the minimum must be such that an image can be formed on the proper field of vision. In his experience the visual acuity under these conditions should be equal to at least 1/10 for the worse eye.

S. B. MARLOW.

Visual Tracts and Fields

OBSERVATIONS ON THE VISUAL FIELDS IN VARIOUS FORMS OF VITAMIN A DEFICIENCY. S. M. KIANG, Nat. M. J. China **18:** 827 (Oct.) 1932.

In six cases of vitamin A deficiency of various forms and severity there was found concentric contraction not only of the blue but also of the red and white fields. In two of the cases there was an inversion of the blue and red fields on admission, and then an intersecting of the blue and red fields, and finally the blue field became larger than the red field. In the other two cases there was an intersecting of the blue and red fields on admission, and then the blue became larger than the red field, while in the remaining two cases there was an inversion of the blue and red fields on admission, and an intersecting of the blue and red fields on discharge. The length of the time from the intersecting of the blue and red fields to the point when the blue field became larger than the red was ten days. In view of the clinical symptoms no definite relationship between the changes in the visual fields, on the one hand, and the clinical symptoms, on the other, can be expressed and figured, but as a whole the contraction of the color fields, especially of the blue, is proportional to the other clinical symptoms of vitamin A deficiency, and therefore the changes of the color fields may be regarded as one of the main symptoms of the eye in vitamin A deficiency in adults.

S. H. MCKEE.

THE VISUAL FIELD IN THE VISION OF RELIEF. L. ALAERTS, Arch. d'opht. **50:** 265 (April) 1933.

In looking at stereoscopic pictures it is easy to see that the two pictures are not superimposable. There are only two points which can be superimposed; all the others are separated and are thrown on homolateral parts of the retina, but not on corresponding points. The failure of this separation to produce diplopia is explained histologically by the difference in the conducting mechanism in the macula and in the periphery. In the macula each individual cell has its conductor so that

the least separation of the images produces diplopia. In the periphery of the retina several visual cells are grouped to one conductor so that even though there is considerable separation the chances of stimulating a corresponding conductor are many. For this reason the author believes that one should speak of "corresponding zones" rather than of "corresponding points." He has had the opportunity to examine some patients with central scotomas by means of the stereoscope; all had good vision in relief. Furthermore, he discovered 2 children in the course of the examination of 3,000 school children who had good vision and markedly constricted fields of vision but no vision in relief. These observations refute Strohl's contention that vision in relief presupposes good visual acuity. Furthermore, he has examined several patients with homonymous hemianopia who had good vision in relief. In the case of heteronymous hemianopia there was no vision in relief. These observations led him to conclude that the peripheral retina is the most important factor in vision in relief. More exactly, it is the integrity of two homolateral halves of the visual field that makes vision in relief possible.

S. B. MARLOW.

QUADRANTAL HEMIANOPIA NOTED SIXTEEN YEARS AFTER GUNSHOT INJURY. J. EUZIÈRE, H. VIALLEFONT, J. VIDAL and ZAKHAJM, Arch. Soc. d. sc. méd. et biol. de Montpellier **14:** 40, 1933.

Sixteen years after a gunshot wound the x-rays revealed a fragment of the shell immediately outside of the atlas, adjoining the cranial base. Study of the visual fields disclosed a typical left superior quadrantal hemianopia. The juxtacranial position of the fragment indicates that the cerebellar and optic disturbances noted in the patient were of commotional origin. This type of hemianopia is easily tolerated and was completely ignored by the subject.

J. E. LEBENSOHN.

IRREGULAR QUADRANTAL HOMONYMOUS HEMIANOPIA. H. VILLARD and C. DEJEAN, Arch. Soc. d. sc. méd. et biol. de Montpellier **14:** 61, 1933.

A man, aged 58, with cardiac insufficiency became suddenly affected with left hemiparesis. Kernig's sign was positive. The neck was rigid; the spinal fluid was bloody and under tension. There was left superior homonymous hemianopia. All the symptoms except the field defect cleared after several days. The blood in the spinal fluid indicated a vascular lesion, and the transitory meningitis suggested a superficial involvement. The lesion was probably, therefore, a hemorrhage from a branch of the calcarine artery, involving the cortex about the calcarine fissure.

J. E. LEBENSOHN.

Vitreous

HEMORRHAGE WITH A PROLAPSED VITREOUS POUCH. T. H. BUTLER. Brit. J. Ophth. **17:** 343 (June) 1933.

This case is recorded to aid in the elucidation of the structure of the vitreous. In Butler's opinion, it greatly strengthens the view that there are tangible membranes in the vitreous: If they will form a bag that holds blood, the idea that they are optical illusions falls to the ground.

Following a preliminary iridectomy, an extraction of the lens was done one week later. The anterior chamber was filled with blood. This cleared and was followed by a second hemorrhage. This absorbed, but the pupil became occluded by an opaque membrane. After a needling there was a prolapse of vitreous into the anterior chamber, forming a biloculate pouch half full of fresh blood, making a double collection. The biomicroscope showed the usual deposit of particulate brown pigment on the surface of the prolapsed vitreous. The blood came from the interior of the eye.

This observation quite definitely demonstrates that the vitreous can prolapse in the form of a pouch that is capable of holding fluids. The pouch in this case was not the hyaloid membrane, as the discission was a deep one. It seems to prove that the vitreous either contains membranes or is capable of rapidly forming them when prolapsed. The article is illustrated.

W. ZENTMAYER.

Sympathetic Ophthalmia

J. MELLER'S THEORY OF SYMPATHETIC OPHTHALMIA AND SCHIECK'S INJECTIONS OF THE PATIENT'S BLOOD INTO THE ANTERIOR CHAMBER. W. RIEHM, Klin. Monatsbl. f. Augenh. **90**: 477 (April) 1933.

Basing his opinion on E. Loewenstein's research, J. Meller considered that sympathogenic inflammation of an injured eye is the result of an endogenous, or hematogenous, infection of the ueva if virulent tubercle bacilli are present in the blood without causing any symptoms of bacillemia. The second eye is affected, in Meller's opinion, through direct metastasis due to these bacilli. This view may suggest the erroneous conception that Schieck's injections of autogenous blood into the anterior chamber might produce tuberculous superinfection in the injured eye and sympathetic ophthalmia in the second eye. No occurrence of this kind was observed in fifty injections at Schieck's ophthalmologic clinic at Würzburg.

In Riehm's opinion, the second eye becomes infected with bacilli originating from the intrathoracic focus, not from the injured eye. The posttraumatic unilateral or bilateral tuberculous uveitis is caused by bacilli which have been weakened by antibodies, so that their increase in the patient's eye is impossible. The bacilli do not acquire an affinity for the uvea, but elective sensibilization of the uvea for the bacilli is possible. Experimental and therapeutic data in corroboration of Riehm's opinion are appended.

K. L. STOLL.

Therapeutics

TREATMENT OF PALPEBRAL ANGIOMAS BY ELECTROLYSIS AND RADIUM. MANUEL MARÍN AMAT, Arch. de oftal. hispano-am. **32**: 604 (Nov.) 1932.

Two cases of palpebral angiomas were treated, respectively, by electrolysis and by radium, with excellent results. After comparing both methods Marín concludes that, in accordance with present therapeutic knowledge, radium and bipolar electrolysis constitute the most efficient

means at one's disposal in the treatment of palpebral angiomas. When the angiomas are circumscribed to the lids with only a slight invasion of the adjacent regions, he prefers electrolysis. When there is great invasion of the surrounding areas, especially if the condition is complicated with hemorrhages, radium is to be preferred. The article is illustrated.

C. E. FINLAY.

AUROTHERAPY IN SCROFULOUS OPHTHALMIAS. PEDRO MATA, Arch. de oftal. hispano-am. **33**: 9 (Jan.) 1933.

After a detailed review of different points of view of the relation of scrofula and tuberculosis, from 1850 to this day, Mata concludes in favor of an identical pathogenesis, the difference in clinical manifestations arising from differences in resistance to the tubercle bacillus, which may in consequence present morphologic and other variations.

He has employed the different therapeutic measures based on this point of view—tuberculin, hygienic and dietetic treatments, Spengler's immunizing bodies—with more or less similar nonsatisfactory results. For the last three years he has been using gold salts. He reviews the action of these, with the different explanations offered, leaning to Mollard's, which attributes it to modification of the "terrain" by the combined action of gold and sulphur contained in the three preparations employed which were all gold thio-organic compounds.

C. E. FINLAY.

Society Transactions

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COLLEGE OF PHYSICIANS OF PHILADELPHIA
SECTION ON OPHTHALMOLOGY

LEIGHTON F. APPLEMAN, M.D., *Chairman*

Feb. 16, 1933

ALEXANDER G. FEWELL, M.D., *Clerk*

THE RESULTS OF CATARACT EXTRACTION BY THE SIMPLE, THE COMBINED AND THE INTRACAPSULAR METHODS. DR. WALTER R. PARKER, Detroit (by invitation).

Four hundred and fifty cases of extraction of senile cataract by the combined, simple and intracapsular methods, including one hundred and fifty cases for each method, are reported. The cases selected for the simple operation were presumably uncomplicated, the patient having a large cornea and a dilatable pupil and being well behaved. The cases selected for the intracapsular operation (performed after the Knapp-Torok method) were presumably uncomplicated, the patient being at least 60 years of age, the eyes not prominent, the cornea large, the pupil dilatable and apparently under good control. A large incision, including a conjunctival flap, was attempted in every case, and no sutures, corneal or conjunctival, were employed. In the cases of extraction after the combined or the simple method, the anterior chamber was irrigated, unless there was loss or impending loss of vitreous. A comparison of the visual results obtained was based on the number of cases in each series with 6/12 or better and 6/15 or better vision, these calculations being derived after all pathologic conditions that might contribute to faulty vision had been eliminated.

	6/12	6/15
Combined	87.4%	95.8%
Simple	87.2%	93.2%
Intracapsular	84.3%	94%

Loss of Vitreous.—All cases of loss of vitreous however slight were included in the report. This complication appeared in 2 per cent of the cases in which the combined method was used, in 3.3 per cent of those in which the simple method was used, and in 6 per cent of those in which intracapsular extraction was done. In no case was the loss of vitreous a demonstrable factor in the visual result obtained.

Prolapse of the Iris.—This untoward event occurred in 1.3 per cent of the cases in which the combined method was used, in 4 per cent of those in which the simple method was used, and in 2 per cent of those in which the intracapsular method was employed. In three cases

infection developed, i. e., once in each series of one hundred and fifty cases or in 0.007 per cent of the entire four hundred and fifty cases.

Secondary Cataract.—A secondary cataract was present in 22.7 per cent of the group operated on by the combined method, in 32 per cent of the group operated on by the simple method and in 5.3 per cent of the group operated on by the intracapsular method. In no case was an operation for secondary cataract followed by a serious reaction. There were two deaths, one from pneumonia and one from tuberculosis and pneumonia.

SOME FEATURES OF THE INTRACAPSULAR EXTRACTION. DR. ARNOLD KNAPP, New York (by invitation).

Great advances have been made in preliminary preparation, such as paralysis of the orbicularis palpebrarum, subconjunctival injection and suture of the superior rectus.

The disadvantages can be considered best by a study of the complications, and these are taken up as furnished by a survey of a fourth hundred successive intracapsular extractions. An analysis by cases follows:

Type of Cataract.—Hypermature, 20; mature, 28; immature, 30; complicated, 22.

Resulting Vision in the Uncomplicated Cases.—20/20 in 51; 20/30 in 27; less than 20/30 in 22.

Mode of Extraction.—Tumbling, 97; capsule ruptured and separately extracted, 2; head-on, 2; pulled out, 1.

Complications.—Hyphemia, 11; prolapse of the iris, 4; loss of vitreous, 5; late prolapse of the vitreous, 4; maculae corneae, 3; chronic iridocyclitis, 1; detachment of the retina, 2; secondary glaucoma, 2; glaucoma, 4; iridocyclitis, 1; central choroiditis, 4; amblyopia, 1; retinitis pigmentosa, 1; retinitis (diabetic), 2.

USE OF A CORNEAL OR CONJUNCTIVAL STITCH IN CATARACT EXTRACTION. DR. E. C. ELLETT, Memphis, Tenn. (by invitation).

The employment of some form of suture for closing the wound after an extraction of cataract has been advocated by many operators. I have had most experience with the corneoscleral stitch of Kalt and the conjunctival flap and sutures of Van Lint, both of which are described. While the use of a suture or sutures may add something to the manipulation and to the time, their use is advocated because they prevent or at least minimize loss of vitreous and prolapse of the iris, permit a deliberate and careful dressing of the wound by irrigation and suction whenever necessary, promote early closure of the wound and lessen postoperative astigmatism. Special needles and thread are required for the Kalt suture, but ordinary small needles suffice for other forms since most of them are conjunctival sutures only.

DISCUSSION

DR. THOMAS B. HOLLOWAY: In regard to the type of operation, I prefer the combined extraction to the simple extraction. In many complicated cataracts I still do a preliminary iridectomy. I should

like to refer to the recent statistics of Sinclair and those of Elschnig, as presented by King, and compare them with certain figures submitted by the essayists. I feel that the younger ophthalmic surgeons and those operators who perform but few operations should consider statistics presented by older and more experienced operators. As there is little doubt that efficiency is more difficult to attain in the intracapsular than in the combined method, the groups just referred to should first master the combined extraction. Dr. Parker's statistics do not show marked differences in the end-results and I feel that the surgeon with limited material and with these facts before him should give his patient the advantage of what probably would be for him the easier operation to perform. Subsequently, the operator should become familiar with the intracapsular method.

I do not use the corneal suture and I note that Dr. Knapp does not use it, yet the losses of vitreous which he reports compare favorably with those encountered by the operators who did.

DR. C. E. G. SHANNON: My mission tonight is to discuss briefly the extremely interesting paper of Dr. Knapp.

We are agreed that the Smith method is unacceptable; that the Barraquer operation as performed by Barraquer is a beautiful procedure and that his technic is beyond criticism, but that it is unsuitable for use by the average operator in this country, and that, finally, the Knapp or Knapp-Torok, Stanculeanu or Elschnig method is generally recognized as the one most suitable to most requirements.

I find it advantageous to inject 4 minims (0.24 cc.) of epinephrine hydrochloride fifteen minutes before the operation in order to secure a persistent dilatation of the pupil following the section. May I add further that a clearer view of the capsule and a more satisfactory grasp can be accomplished by standing to the side of instead of behind the patient?

There are two points I should like to have Dr. Knapp clear up: One is the broad iridectomy. I am inclined to a narrower iridectomy to prevent the possibility of subsequent dazzling. Second, I note that he regularly does an iridectomy. In this connection, King's paper refers to the fact that Elschnig in his 1,522 cases had 1,221 of the simple type. This is an extremely interesting point to my mind. Elschnig, however, according to King, always does an "iridectomy in patients over 75, in obese patients, those suffering from emphysemia or chronic coughing, and nervous and non-cooperative patients."

DR. LUTHER C. PETER: An intact pupil insures good and comfortable vision. It does much more. Loss of vitreous or even presentation without loss becomes almost a negligible factor. In my experience, a peripheral iridotomy is safer than a simple extraction without it. A small horizontal opening is easily made with Barraquer's delicate modification of the De Wecker scissors. For some time I have been doing the iridotomy with a small Ziegler knife-needle, which seems to be more satisfactory even than the Barraquer scissors.

The four distinct points of advantage to be gained by intracapsular work need emphasis:

1. A minimum amount of trauma to the tissue is of first importance. This is well illustrated in the slight reactions after intracapsular extrac-

tion, the more rapid convalescence than with older methods, the absence of serious complications such as secondary glaucoma, secondary cataract, which calls for a discission, and late epithelial activity, which occurs in a year or two after operation. In my series of cases there was moderate loss of vitreous in 4 per cent and presentation of vitreous in 5 per cent, a total of 9 per cent. In none of these cases did loss of vitreous materially lower vision or the ultimate integrity of the eye.

2. The eye is left in as nearly normal a state as is possible after the lens is removed. This includes a minimum amount of inflammatory changes in the eye and preservation of the pupil when possible. Herniation of the vitreous is rarely observed two months after operation and when present in my experience thus far has not interfered with normal function.

3. The better visual results are without question. This fact is substantiated in practically all reports of series of cases presented. In my own series of available results, mostly those in private cases, vision of 6/5 or better was obtained in 43 per cent of cases, vision of 6/6 in 34 per cent and vision of from 6/7.5 to 6/15 in 21 per cent. In forty of my earlier cases of capsulotomy, the records of which I have hurriedly gathered for purposes of comparison, vision of 6/5 or better was obtained in 36.3 per cent, vision of 6/6 in 27.3 per cent and vision of from 6/7.5 to 6/15 in 40 per cent. In a similar series of ward cases, the smooth forceps and suction methods yielded an average vision of 6/6.5 per case, and capsulotomy an average of 6/11. These cases were not selected; the records were gathered as they appeared in the files.

4. Any method that requires but one operative step rather than two or three should receive careful consideration. An iridectomy may be indicated in a few selected cases. The beginner is justified in doing a two-stage operation, but in general there are good reasons why one should complete an extraction at one hospitalization. Most of the patients are along in years and dread the necessity of going to the hospital two and three times to obtain results on a single eye. Each operation adds to the trauma of tissue and multiplies the exposure to infection. The added expense is also a matter to be considered. But, after all, the end-results are the criteria by which one should judge. When the complications and advantages in the several methods are carefully weighed there is little opportunity for doubt as to the better end-results in intracapsular work.

Some form of conjunctival, corneoconjunctival or sclerocorneal suture is essential for good results. Multiple conjunctival sutures have seemed to be the best form in my hands. The same form of suture is used by Barraquer and a similar one by Elschnig. In this suture it is best, when possible, to include an episcleral bite rather than a purely conjunctival one. It insures better coaptation and prompter union. For this reason, a narrow conjunctival flap is better than a generous one.

Dr. L. F. Appleman: In 1929 I began to do the intracapsular operation according to the Knapp modification, and I have been extremely gratified with the results, first on account of the simplicity of the procedure and second on account of the avoidance of secondary capsular remnants and the rapidity of postoperative recovery, which in many

cases is really remarkable. The eye was dressed forty-eight hours after operation, and in many cases scarcely any reaction was seen, the patient recovering remarkably quickly, so much so that in the series of one hundred cases which I reported in November, thirty-six patients were discharged nine days after operation, and twenty-eight within from ten to twelve days after operation, which was to me remarkable.

DR. WALTER R. PARKER: I should like to confirm one point that Dr. Holloway has made. If I were to classify the different methods of cataract extraction with which I have had experience with regard to ease of performance, I should put the combined first, the simple second, and the intracapsular third.

In consideration of statistical compilations of results that compare the old operation with the intracapsular operation it is essential to know whether or not the anterior chamber was irrigated. In my own experience the results have been uniformly better since irrigation of the anterior chamber has been done when possible.

DR. ARNOLD KNAPP: The wide iridectomies that Dr. Shannon refers to are not attempted purposely, and I quite agree that the narrow iridectomy is desirable.

I was much interested in seeing Elschnig operate last summer. He favors simple extraction with a buttonhole iridectomy and deep orbital injection. While grasping the capsule with the blunt forceps, he exerts strong pressure with the hook straight back. Extraction by traction can be employed in simple just as well as in combined extraction. If one prefers to release the capsule forceps after subluxation, the procedure is more difficult if an iridectomy has not been done.

DR. E. C. ELLETT: If a stitch is used at the apex of the cornea, it is not possible to get a regular flap, but it is possible to make the section so that one gets a double conjunctival flap, with one part on each side of the stitch.

In regard to Dr. Peter's question, my impression is that when one has to do with a considerable number of cases the astigmatism is lessened as an average.

LEIGHTON F. APPLEMAN, M.D., *Chairman*

March 16, 1933

ALEXANDER G. FEWELL, M. D., *Clerk*

DISCIFORM DEGENERATION OF THE MACULA. DR. FRANCIS H. ADLER.

Very interesting lantern slides of this condition were shown.

ECTASIAE OF THE CORNEA IN KERATOCONUS. DR. GEORGE E. BERNER (by invitation) and DR. FRANCIS H. ADLER.

Interesting lantern slides of this condition were shown.

FUSION TRAINING IN CONCOMITANT SQUINT, WITH SPECIAL REFERENCE TO AMBLYOPIA. DR. H. MAXWELL LANGDON.

The modern treatment of concomitant strabismus is directed at two points, the physiologic defects and the anatomic disarrangements.

Parents know only about the latter, which they can see. For the welfare of the child the functional disturbances are more important. Donders noted that convergent strabismus in children usually had underlying hyperopia, and he believed that this was a great factor in the production of the squint. Claude Worth believes that the condition of the fusion sense is the determining factor for the appearance or the absence of squint. One frequently sees cases of high hypermetropia in patients without squint but with good fusion sense, and one also sees cases of much less hypermetropia in patients with poor fusion sense and strabismus. In alternating squint there is not apt to be suppression of vision in one eye, but in the great majority of unilateral cases the disuse of the deviating eye is apt to result in amblyopia from suppression of the image. Congenital amblyopia occurs, but it is rare.

A squinting child should be under observation as soon as the squint appears; a deviating eye should have its function stimulated by occlusion of the preferred eye; glasses should be prescribed as soon as the child is old enough to wear them, not later than the age of 18 months, and the fusion sense should be trained with the stereoscope or the amblyoscope. The restoration of normal vision in an amblyopic eye is one of the most important objectives in the treatment of strabismus, and this must be begun early and must be completed by the time the child is about 6 years of age. If squint does not disappear with this treatment, as is frequently the case, the muscles should be corrected by surgical methods.

THE ORTHOPTIC CLINIC OF THE FIFTH AVENUE HOSPITAL. DR. LEGRAND H. HARDY (by invitation).

A conviction that some children suffering from squint may be relieved of all their symptoms by orthoptic training, and that many who require surgical treatment as well will be more completely and permanently cured if the surgical treatment is supplemented by attempts to develop and integrate the function of the eyes, led to the establishment of the Orthoptic Training Clinic at the Fifth Avenue Hospital.

The clinic is modeled after that established at the Royal Westminster Ophthalmic Hospital by Miss Mary Maddox, who has been exceedingly generous with aid and advice.

The clinic is established as a unit separate from the rest of the ophthalmic department. The patients are divided into three groups, one, under the direction of Miss Stark, being given intensive, systematic training with the synoptophore, and the other two being studied by staff ophthalmologists on alternate days. Regular attendance has been encouraged by a variety of rewards, responsibilities and a definite program.

Material from all three groups is being used for research; several of the research problems and tentative lines of approach to their solutions are discussed. Some of the problems included in the discussion are: the scotomas, amblyopia ex anopsia, innervational imbalances, fusion, projection, various forms of occlusion and the treatment of amblyopia.

DISCUSSION

DR. J. MILTON GRISCOM: It is fortunate that in a large proportion of cases manifest squint develops early in life, and that which seems to be tragedy so far as the appearance of the child is concerned is really a blessing, since advice is usually sought at once. On the other hand, it is unfortunate that an attitude of defeatism exists among a large group of ophthalmologists who feel, as a result of their own experience or the reports of others, that little can be done, especially after the eighth year of age. Through the years, however, a group who have not been satisfied to allow amblyopia and concomitant squint to be classified as idiopathic, and those who have been impelled by a desire to restore vision whenever possible, have gradually opened the door to a better understanding of the condition and a more intelligent basis of treatment.

In each case the objective should be to secure normal vision, orthophoria, fusion capacity and stereoscopic vision. To attain this end one should consider carefully the various theories concerning the relation of squint and amblyopia, since at present no one theory fits all cases. This has a direct bearing on treatment, since time and trouble may be saved if the proper line of attack is adopted. For instance, if one believes that the amblyopia is due to the squint, one operates early, regardless of the degree of deviation. If one believes that the squint is the result of unequal vision in the two eyes, or of congenital amblyopia, one gives visual amblyopic and fusion training in those cases in which the squint is 25 degrees or less, and operates only when the squint is high in degree or the training fails. In other words, it is possible to develop a rational line of treatment in each case, according to the symptoms presented.

This much can be said with certainty, that poor results can be expected if an attempt is not made to establish the type of amblyopia and squint in each case. Then one must be prepared to exercise patience and persistence until one has exhausted all means and methods at one's command.

DR. LUTHER C. PETER: The papers of the evening open up many phases for discussion. Central scotoma and amblyopia ex anopsia are of prime importance. The central scotoma, in my experience, is a relative one of about 2 or 3 degrees in diameter. It is best uncovered by a special equipment on the Ferree-Rand perimeter. I have had a special tangent screen made, in which the central opening is little more than a pinhole. A light is placed at the back of the instrument, which shines through the opening, and on which the patient fixes. The light penetrates the central scotoma if it is an acquired scotoma. Little difficulty is experienced in outlining this small relative blind spot.

It is an important and yet easy matter to differentiate between amblyopia ex anopsia and congenital amblyopia. The essential difference lies in the size and the contour of the blind spot. In most instances, the amblyopia found in monocular squint is the acquired variety, and when training is begun sufficiently early, i. e., before the end of the sixth year, in a majority of instances normal vision can be restored by proper methods. Each year after the seventh, however, adds increasing difficulties to bringing back vision to normal. I have been able to restore

vision in patients up to the nineteenth and twentieth years of age. It is probable that beyond this age it would be exceedingly difficult to bring vision up to normal. In fact, in adults, when it is possible to bring vision up from 6/30 or 6/22 to 6/12 it is probable that the vision is slightly extramacular and that the scotoma is still present.

The synoptophore, in my experience, is one of the best adjuncts to the training for squint. It is pliable in its application and can be used for training in the various stages of amblyopia and in fusion. It is especially useful in bringing about fixation in cases of profound amblyopia. Here the flashing device is of great value. Of even greater value, however, is the revolving type of stabilizer, in which the same flashing method can be used by a rotating colored disk, which can be rhythmically flashed and followed. Unfortunately, this device is not in the hands of many oculists, but rather in the hands of those who are less qualified, and who use it for commercial purposes. For awakening fixation in profound amblyopia, as well as in many other phases of squint, I find it excellent.

I have referred to the possibility of developing fusion at any time of life. Just recently I operated on a man, 43 years of age, who had suffered from paralysis of the left superior rectus and overaction of the right inferior oblique from childhood. On the third day after a tenotomy of the right inferior oblique and a tucking of the left superior rectus the patient acquired, for the first time, single binocular vision. In a few days he was able to fuse any cards in the sterescope and had full stereopsis. This is only a single illustration of many in my experience showing that fusion can be developed at almost any time of life.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY, SECTION OF OPHTHALMOLOGY

Thirty-Eight Annual Meeting, Boston, Sept. 16 to 22, 1933

SOME COMMENTS REGARDING TRAUMATIC CATARACT. DR. ARTHUR J. BEDELL, ALBANY, N. Y.

Dr. Bedell emphasized the necessity of distinguishing between a cataract caused by an injury and one which develops after an accident but which is in no way caused or influenced by a trauma. The examination of the uninjured eye frequently discloses signs that are of value in classifying correctly the cataract from the standpoint of etiology.

Several illustrations were presented to show the types of traumatic cataract. Reference was made to the difficulty in differentiating retained pupillary membrane, glass-blower's cataract and exfoliated lens capsule. The so-called leaf-shaped opacities were dwelt on at some length, and by means of histories and photographs it was shown that they are not always traumatic in origin. The majority of those which he reported were, however, the direct results of ocular injuries. He stressed the fact that a diagnosis of traumatic cataract should not be made in a puzzling case until all available data secured by an exact

history and a complete examination, including detailed slit-lamp study, are collected and analyzed. Even then care must be taken to recognize and exclude the rare or unusual forms of cataract which are in no way caused by injury.

DISCUSSION

Dr. Frank E. Burch, St. Paul: The author has pointed out the very great importance of the history in the diagnosis of traumatic cataract. To me, it is quite as important as the physical findings. Three instances were cited to illustrate the importance of a complete history as an aid in prevention of fraudulent claims for compensation.

There is usually no difficulty in diagnosing a recent perforating injury when the capsule is broken, but a foreign body may leave a pathway between the anterior and posterior capsular wounds with very little opacity of the lens substance through which it passes. This slight opacity may remain stationary. I have observed several instances of an eye with a history of injury occurring years previously in which useful vision was retained, with an opacity running through the lens substance, even though both capsules had been penetrated. These instances probably are extreme examples of a repair process in the capsule. One can explain them only by the assumption that the capsular openings closed quickly and that no extensive disintegration of the lens fibers occurred. Incidentally, the use of atropine is contraindicated in every case of perforation of the capsule unless the corneal wound is still open.

A fair number of traumatic cataracts may remain as capsular opacities. One may be able to find both a corneal and an iris wound and a wound near the equator of the lens, the opacity of the lens remaining entirely localized and stationary. I mention this because the prognosis of an entirely bad result from penetrating wounds of the lens capsule is not always warranted. Even in the typical rosette type of traumatic cataract found just under the posterior capsule, the outcome is not invariably bad. An opacity following a contusion or a perforating injury may remain stationary or even clear up beyond one's expectation.

Dr. Edmond Blaauw, Buffalo: Recently, A. Vogt has called attention to the finger form of cataract as a symptom of concussio bulbi. When there has been a perforating injury, the result may take this form, which hardly progresses. Occasionally, when there has been a contusion, an opacity may develop from one to three days later only to disappear by resorption, or it may go on to complete opacification. One cannot predict the outcome of a trauma of the bulb, especially as regards the behavior of the lens. Whatever the rosette form represents, somehow in the mind of the ophthalmologist it has become nearly a dogma that the distance of the rosette from the capsule of the lens proves the age of the rosette, and that its presence proves a direct trauma of the ocular bulb. I am glad that Dr. Bedell has shown that this is only a part of the truth, and also that the rosette appears sometimes in both eyes (Handmann). Another interesting observation is that it can be found deep in the cortex even very shortly after the accident.

Dr. Robert von der Heydt, Chicago: Dr. Bedell's last two pictures showed the delayed rosette type of contusion cataract, as described by Vogt. This cataract definitely tells that there has been a contusion of

the eye. The shape of the rosette follows the outlines of the central suture system. In time it becomes more opaque and is pressed inward by the formation of new lens fibers. The thickness of the layer of new fibers allows an estimation of how long ago the contusion occurred. One can also tell the direction of a diagonal blow by the fact that the rosette may be incomplete. It may show a leaf form in one sector. This proves that the blow came from that side. Vogt has recently shown an interesting picture of the incipiency of this type of cataract. It starts as a very faintly visible rosette under the anterior capsule.

There is another type of traumatic rosette cataract that has not been mentioned. It is a very important type: the posterior rosette. The posterior rosette is a transient rosette seen after a very minor perforation of the capsule. The very slight local perforation of the capsule allows a little of the lens substance to ooze out. The lens volume within the capsule is thereby reduced and the designs of the posterior surface of the lens become manifest, forming a very beautiful rosette. This rosette is transient and disappears as the capsular opening closes and the lens regains its normal volume.

Dr. H. S. Gradle, Chicago: One additional point which Dr. Bedell might have made in the diagnosis of concussion cataract might be brought out to advantage here. When a minor blunt injury to the anterior segment of the eye occurs, it may manifest itself as a rupture of the iris. The rupture may be only microscopic. In the majority of cases in which the force that strikes the eye is adequate to produce a contusion or concussion cataract, the force is also adequate to produce a rupture of the iris. This may take one of three forms: It may be a rupture merely of the fibers of the anterior stroma; it may be a rupture of the posterior pigmented epithelium, with the anterior stroma undisturbed, or it may be a rupture through both the anterior and posterior layers.

Intracapsular Extraction of Cataract. Dr. Luther C. Peter, Philadelphia.

Dr. Peter discussed the relative values of the modern methods of intracapsular extraction of cataract and the indications for their use. Four methods of extraction were alluded too: by the loop, by the Smith-Indian technic, by the smooth capsule forceps and the Smith hook, and by vacuum fixation. The relative value of each method was outlined, with an indication of the type of cataract for which it is especially adapted, as shown by the author's experience.

DISCUSSION

Dr. Walter Lancaster, Boston: As to the method of dislocating the lens, whether the method described by Elschnig, which is Stanculeanu's method, or the method which I described in 1916 and have used ever since, that of combining traction and pressure, it seems to me obvious that there will be fewer ruptures of the capsule when one combines the two than when one relies wholly on traction, and that there will be fewer losses of vitreous and fewer other complications

if one combines traction with pushing than if one relies on pushing alone, as in the Smith-Indian method. It seems to me that this is axiomatic.

I do an iridectomy after the extraction, and I do not do an iridotomy, as Dr. Peter recommended. The most striking testimony in favor of an iridectomy buttonhole at the periphery rather than an iridotomy is Šafář's experience. He went to Prague and saw Elschnig operate and went back to Vienna and tried that method, using the iridotomy. He witnessed prolapse of the iris in about 20 per cent of his cases. He then adopted the method of buttonhole iridectomy, which I now use. The iris having been replaced, I can grasp it at the periphery and cut off a very small piece. This method was first used here in Boston by my chief, Dr. Chandler, in the last century, and was afterward taken up by Hess and others. After adopting this, Šafář's percentage of prolapse of the iris went down almost to zero. I feel sure that the buttonhole peripheral iridectomy is better than iridotomy.

Dr. E. C. Ellett, Memphis, Tenn.: The conditions necessary for a successful extraction as outlined by Dr. Peter agree with what I hold to be requisites, but I should add a preliminary dose of sodium amytal or a similar drug and insist on quiet in the operating room, both designed to promote the patient's tranquillity. In addition to the local anesthesia by drops, a little under the conjunctiva seems to render the iris less sensitive. Control of the orbicularis oculi is best achieved, in my experience, by O'Brien's method of injecting the anesthetic into the facial nerve over the temporomaxillary joint. This does not take care of the recti, the importance of which in disastrous squeezing has been especially dwelt on by Dr. Lancaster, but good anesthesia and a sedative help in this respect. Some operators use a retrobulbar injection of procaine hydrochloride, which intensifies the anesthesia and controls the recti as well. This is not without the danger of orbital hemorrhage and disastrous results, and I have not used it in work on cataracts. All these precautions are especially necessary in the intracapsular extraction, in which loss of vitreous is more probable than in an extraction by capsulotomy. In certain patients who cooperate poorly, the Guist speculum and fixation of the superior rectus, as emphasized by Melville Black, Arruga and others, are a blessing from heaven. My own experience agrees with Dr. Peter's as regards the advantage of a peripheral over a complete iridectomy. Arruga, in a paper read before the French Society of Ophthalmology this summer, advocated making a peripheral iridectomy before the delivery of the lens. One can make the opening with one of the points of a sharp scissors, as Elschnig does, or a stab iridotomy can be made with a knife needle, but the latter wounds the hyaloid membrane and permits the vitreous to come forward, with unpleasant results, so that I have given up the plan. With a forceps or a sharp hook the iris can be picked up and a small basal iridectomy easily made.

Dr. Edmund B. Spaeth, Philadelphia: After the corneal section has been made, if the wound tends to gape a bit, a capsule forceps should be used, rather than the Barraquer instrument. On the other hand, if the central position of the cornea is pitted and concave, extraction can be done readily in capsule—by any method indicated. A prominent eye is not a contraindication to intracapsular extraction. It may demand

some modification of the anesthesia and more care on the part of the assistant holding the lids. The results obtained after intracapsular extraction of a cataract complicated by old iridocyclitis with posterior synechiae of the iris make an almost imperative demand on the operator for intracapsular extraction in all such cases. When the synechiae can be released by an iridectomy and through manipulation with an iris spatula, the operator knows that healing will not leave an occluded and secluded pupil, necessitating subsequent iridotomy. Here, again, one may use the smooth forceps, but if the vacuum method can be used, the results will speak for themselves. Retrobulbar anesthesia gives a soft eye; the anesthesia is complete; the rolling and squeezing action of the recti is reduced to a minimum, and the injection into the lids at the outer canthus controls adequately the fibers of the orbicularis. Further, persons who are highly nervous—those of excitable dispositions, those who cannot understand one, whether one is speaking English or some other language, and one-eyed patients who have had an operation for cataract in the opposite eye ending in catastrophe—may be safely operated on under avertin anesthesia without resorting to a technic involving capsulotomy. In extraction within the capsule, the presence of sutures is almost a guarantee of the possible results during healing. The wound is held closed; it heals more rapidly; the danger of prolapse of the iris is minimized; the anterior chamber certainly forms more rapidly, and the patient can move about more freely in bed without danger of the wound reopening. Also, it is not at all unlikely that the sutures assist later in minimizing the degree of corneal astigmatism.

DR. ALLEN GREENWOOD, Boston: If I have a patient with a fairly mature cataract which I want to extract in the capsule, and I find on lifting the lids that there is no negative pressure in the eye, that the lens is right up against the cornea and that evidently the tension is high, I drop the capsule forceps, open the capsule and take the lens out the other way. I think the absence of negative pressure in the eye is a valuable indication as to when it is perhaps best to shift from one instrument to another.

DR. CLIFFORD B. WALKER, Los Angeles: As has been noted, capsule forceps vary considerably, not only with respect to the make, but individually. Therefore, I have sacrificed each lens capsule, after intracapsular removal of cataract, to find out what tension in ounces the capsule would stand under various conditions before it ruptured. For instance, capsule forceps of two different makes were attached to the fresh capsule diametrically opposite each other and held with approximately the same force by two other locking conjunctival forceps. Tension was then applied on this preparation and measured in ounces. It was found that the Kalt forceps outpulled all the other forceps at hand, including three of the best known models and that it developed a tension averaging as much as 2 ounces (56.7 Gm.) before it tore the capsule, while other brands easily tore the capsule at ¾ ounce (21.2 Gm.) The reason for this lies in the fact that the Kalt forceps is so constructed that it usually includes a knuckle of subcapsular cortex in its smooth jaws, which, in original models, are very free from sharp points or angles at which a tear may start.

DELIMITING KERATOTOMY. DR. HARRY S. GRADLE and DR. SANFORD R. GIFFORD, Chicago.

This procedure, which was first prescribed by H. Gifford in 1918, has proved to be so useful in the hands of the authors that they have endeavored to bring it again before the ophthalmic profession. They reviewed the literature pertaining to delimiting keratotomy and similar procedures and then described the technic of the operation. It was found to be of value in the following types of ulcer: serpent ulcer, Mooren's phlyctenular ulcer and ring ulcer, in trachoma. Various cases of the different types of ulcer were cited briefly, and some were illustrated with stereoscopic photographs. The final vision in each case was given, and it was shown fairly conclusively that the more severe types of ulcers were controlled more rapidly and with less loss of visual acuity by delimiting keratotomy than by other means.

DISCUSSION

DR. THOMAS D. ALLEN, Chicago: The application of heat, either the radiant heat from a glowing Prince bulb or that from a thermophore at from 145 to 160 F., or even the employment of the actual cautery, seems to me to be more rational than delimiting keratotomy. Prince at one time recommended a procedure for the use of his pear-shaped bulb. The latter is heated and then lightly touched to water till the water ceases to sizzle, which means that the bulb has been cooled to a temperature of 210 or 212 F. The eye having previously been anesthetized, the bulb is now touched to the ulcerated area for one or two seconds. I have used delimiting keratotomy in a few cases on my services, both at the Cook County Hospital and the Illinois Eye and Ear Infirmary, but it has always been combined with other measures such as cauterization, pasteurization, injection of milk, extirpation of the sac, etc. One cannot, therefore, be sure just how much credit to give to each procedure. It is my general impression, however, that one has in this treatment a valuable addition to one's armamentarium, and the authors should receive thanks for again emphasizing its value.

DR. SANFORD R. GIFFORD, Chicago: I think it ought to be emphasized that the chamber should be kept open until the ulcer is practically healed. In some of the cases there is a certain crisis that seems to occur after the chamber is opened. The ulcer begins to heal very rapidly. So in a few of these cases it was necessary to keep the chamber open only two or three days. Usually it is kept open six or seven days. There is something else in the paper which was not brought out in Dr. Gradle's abstract of it. If the ulcer is large, covering the whole of the central part of the cornea, it may be better to puncture the cornea with a thermocautery, making a small puncture right through the center of the ulcer at the thinnest portion. Such an opening will remain for four or five days with the resulting hypotony that is desired, whereas a delimiting keratotomy cannot be made in such a condition, because it would have to be made in the region where the iris would prolapse.

CLINICAL AND EXPERIMENTAL STUDIES OF THE SPREAD OF TUBERCULOSIS IN THE EYE. DR. WILLIAM C. FINNOFF and DR. EDNA M. REYNOLDS, Denver.

The paper is confined to the conclusions drawn from clinical and experimental evidence following observation of various types of intra-ocular tuberculosis. The authors divide the spread from the primary lesion in the eye to distant parts into three types: 1. The bacilli may be conveyed from the primary site in the eye to distant parts by the ocular fluid. 2. The infection may extend by continuity and by enlargement of the primary focus without widespread dissemination of the bacilli. 3. In the miliary form, the ocular infection may be entirely hematogenous and confined to the uveal tract before the patient succumbs.

It seems probable that the first type is one of ocular reinfection. The progress of retinal periphlebitis furnishes the most convincing clinical evidence in support of the first theory.

DISCUSSION

DR. J. S. FRIEDENWALD, Baltimore: Dr. Finnoff has enumerated three types: mechanical spread, in which the tubercle bacilli are carried to various parts of the eye by the intra-ocular fluids; direct extension from an old lesion to its immediate neighborhood; and infection of the blood stream from a remote source. Of these three types of spread, the one which I think is of greatest immediate interest is the first, the mechanical spread by way of the intra-ocular fluids.

There are important analogies to this mechanism in many other organs. All physicians are familiar with a similar type of spread of tuberculosis of the kidney; also it is well known that in tuberculosis of the lung, not uncommonly, a tubercle in a peribronchial lymph node erupts into a bronchus and the tuberculous infection spreads then in purely mechanical ways. Perhaps the closest analogy to the ocular occurrence is the course of events in the central nervous system. Tuberculous meningitis has recently been carefully studied by Dr. Rich, of the department of pathology of Johns Hopkins University, who has concluded that this condition is always the result of the bursting of an initial solitary tubercle somewhere, either in the brain itself or in the meninges, and the discharge of the tubercle bacilli into the spinal fluid with a mechanical spread of the infection throughout the meninges.

CLINICAL DETERMINATION OF THE THRESHOLD FOR LIGHT. DR. EDMUND B. SPAETH, Philadelphia.

This article was published in full in the March 1934 issue of the ARCHIVES, page 462.

THE KAHN REACTION IN THE AQUEOUS HUMOR. DR. F. BRUCE FRALICK, Ann Arbor, Mich.

This article was published in full in the December 1933 issue of the ARCHIVES, page 745.

DISCUSSION

DR. SANFORD R. GIFFORD, Chicago: It appears from Dr. Fralick's work that, in general, the Kahn reaction of the aqueous humor is negative in normal persons and in persons with syphilis who have no ocular disease attributable to an active syphilitic process. It is positive in persons with syphilis in whom there is active involvement of the eye, just as it is positive in the spinal fluid of patients with syphilis of the central nervous system. In healed chorioretinitis and optic atrophy Dr. Fralick found the reaction of the aqueous negative, even though that of the blood and that of the spinal fluid were still positive. As in tabes one may find a positive reaction of the spinal fluid when that of the blood is negative, so it is possible to obtain a positive reaction in the aqueous during ocular disease while the reaction of the blood is negative. Dr. Fralick seems to have found one such case, in which he was led to consider the recurrent iridocyclitis as probably syphilitic though the reaction of the blood was negative. This, of course, would be the important contribution of his work, if it is confirmed in a number of cases. One expects positive Kahn and Wassermann reactions of the blood in syphilic uveitis, which is usually a secondary manifestation, but cases of uveitis occur in which all other factors seem to be eliminated and yet the reaction of the blood is negative. In such cases examination of the aqueous certainly is more logical and more likely to furnish useful information than examination of the spinal fluid, which is sometimes done.

Theoretically, one might expect that the Kahn reaction of the aqueous would be less likely to be positive than the Wassermann reaction. Duke-Elder reviewed the findings of antibodies in the aqueous, and stated that while agglutinins and hemolysins are easy to demonstrate in the aqueous of immunized animals, precipitins have been found by only a few observers, Wesseley and Römer, while others have found them absent. He explained this as due to the large size of the molecule responsible for the precipitin reaction as compared with those of agglutinin and hemolysin, which are of simple nature and more easily penetrate the capillary barriers. If I am not mistaken, the Kahn test depends on something more like a precipitin than any other antibody. Bessemans and Van Canneyt found negative Kahn and Wassermann reactions of the aqueous in most rabbits with syphilitic inflammation of the eyes, but in some animals the reactions were positive. Negative reactions could be made positive by injecting distilled water into the anterior chamber. This simply means that the antibodies were increased in amount by the reactive hyperemia, and this can probably be as well accomplished by paracentesis, the second aqueous being removed several hours later.

DR. F. BRUCE FRALICK, Ann Arbor, Mich.: When one uses rabbits in a study of this type it is advisable to determine the Kahn precipitation reaction of the aqueous and blood before experimental syphilis has been produced, because many apparently healthy rabbits give false Kahn reactions. If a large series of observations confirm the findings given in this report, it will be interesting to determine what percentage of patients of the type described will give a negative Kahn reaction of the aqueous humor when clinically adequate antisyphilitic therapy has

been given. It will also be interesting to know at what point along the course of the antisyphilitic therapy the Kahn reaction of the aqueous humor becomes negative in relation to the negative reactions of the blood and spinal fluid. When these questions are adequately settled, the result may be a criterion on which one may base the amount of antisyphilitic therapy needed to prevent further or recurrent attacks of uveitis.

NEW YORK ACADEMY OF MEDICINE, SECTIONS OF MEDICINE AND OPHTHALMOLOGY

Joint Meeting, Dec. 19, 1933

H. J. SPENCER, M.D., and WEBB W. WEEKS, M.D., *Chairmen*

OCULAR COMPLICATIONS FOUND IN THE STUDY OF TWO THOUSAND DIABETIC PATIENTS. DR. J. HERBERT WAITE, Boston.

Dr. Waite described the methods employed in gathering medical and ophthalmologic facts among 2,002 consecutive diabetic patients from the Joslin clinic and among 457 nondiabetic controls from the medical wards of the Massachusetts General Hospital. He discussed the statistical analysis of the medical and ophthalmologic findings in the 2,459 diabetic and nondiabetic patients in an attempt to correlate the findings. This analysis was aided by the use of punched cards sorted and cross-sorted by means of the Hollerith electric sorting machine.

The history of the major ocular complications was reviewed. The contentions for and against "diabetic cataract" advanced throughout the nineteenth century were cited, and the rôle played by the slit lamp in studies of the lens during the last twenty years was described. The frequency of glycogenic infiltration of the pigmented epithelium of the iris as disclosed by proper histologic methods and the difficulty of clinical recognition of such infiltration were pointed out. Brief mention was made of lipaemia retinalis and of its antecedents, and attention was called to the fact that all but 1 of the 43 cases recorded in the literature occurred in diabetic patients. The exception occurred in a case of leukemia following irradiation of the spleen and resulting high blood fat. The views of various workers and the facts adduced by them to relate retinal hemorrhages to hyperpiesis, angiosclerosis, nephritis and insulin therapy were reviewed.

In summarizing the chief findings in this series it was pointed out that with increasing age of the patient and increasing duration of the diabetes retinal hemorrhages and exudates tended to increase while the severity of the diabetes tended to decrease, as evidenced by lower levels of blood sugar and by lower requirements of insulin. Graphs were exhibited to cast doubt on the validity of the belief that vascular hypertension or sclerosis alone could account for retinal hemorrhages of the type seen in diabetic patients. For example, 62 per cent of these hemorrhages were found in patients with diastolic blood pressure under 90 mm. of mercury. Retinal hemorrhages were found in 18 per cent of

the entire series. The youngest diabetic patient with retinal hemorrhages was 16 years old, and 15 of the patients with hemorrhages were under 40. Two thirds of the patients with retinal hemorrhages showed many hemorrhages, and one third showed few. The incidence of hemorrhages in diabetic patients was 4 per cent during the third decade of life, 15 per cent during the fifth decade and 30 per cent during the seventh decade. The retinal hemorrhages were thought to be due not to diabetes alone, and not to any of the other more commonly assigned causes, but rather to the effect of an unrecognized toxin on capillary permeability.

A group of 31 patients in whom diabetes was mild, but in whom vascular changes were pronounced, renal impairment was the rule and vascular hypertension was constant, showed hemorrhage from the larger retinal vessels and a tendency to retinitis proliferans with detachment of the retina by traction. While insulin therapy in this type of case has been condemned by some workers, it was the opinion of Dr. Waite that prognosis with respect to sight was very poor in this group whatever the treatment might be.

Fine wrinkles in Descemet's membrane were found only by the slit lamp and not by the loupe or the ophthalmoscope in 28 per cent of the entire diabetic series and in 10 per cent of the nondiabetic series. The incidence of wrinkles in diabetic patients was 1 per cent during the third decade of life, 20 per cent during the fifth decade and 50 per cent during the seventh decade. These wrinkles were usually vertical; they were bilateral in 85 per cent of the cases. They were not indicative of inflammation. No obvious correlation could be made out between wrinkles and ocular pressures, constituents of the blood or insulin therapy.

Transitory refractive changes were found in 121 patients, or 6 per cent of the entire diabetic group. In 40 per cent of these patients there was definitely subnormal accommodation for the age. These changes were most common during the fifth decade (10 per cent), but were of the greatest magnitude in young diabetic patients under heavy insulin therapy. Caution was given about a premature change of glasses during transitory refractive changes.

A careful slit-lamp study of each patient with dilated pupils revealed no form of cataract distinctive of diabetes with the one possible exception of the so-called juvenile and bilateral "diabetic cataract" first described by Schnyder. Eleven juvenile diabetic patients had cataract of this type, and in 6 of them there was a question of endocrine dysfunction. Complicated cataracts, as well as all other forms of cataracts, were just as common in nondiabetic as in diabetic patients.

SYMPOSIUM ON OCULAR COMPLICATIONS OF DIABETES. DR. R. M. WILDER, Rochester, Minn.

In preparation for this meeting, Dr. Wilder recently reviewed the summaries of 1,471 examinations of diabetic patients at the Mayo Clinic. These examinations were made in the years from 1928 to 1930, inclusive. Hemorrhagic lesion of the retina was recorded in 132 cases. In the large majority of these cases the patient was over 40 years of age and presented clear evidence of sclerosis of vessels other than those

of the eyes. However, in 25 cases there was no evidence of extraocular vascular lesions. Only 4 of the patients were under 40 years of age. Despite these occasional young patients with no evidence of disease of the arteries Dr. Wilder remains of the opinion that a hemorrhagic lesion of the retina in diabetes is an expression of a vascular disease unrelated etiologically to the metabolic disturbances of diabetes. Were it otherwise, a larger proportion of patients with uncomplicated diabetes should show this abnormality.

An impressively large proportion of diabetic patients who had hemorrhagic lesions of the retina were affected with symptoms suggesting abnormality of the peripheral nerves—about one third of all such patients. This suggests the possibility that capillary hemorrhages similar to those in the retina occur in the peripheral nerves and produce disturbances of function.

The low incidence of anomalies of refraction recorded in this series of cases—only 23 cases—prompted a review of the summaries of cases examined in earlier years. The incidence was much higher in 1923 and 1924—25 per cent then as opposed to less than 2 per cent in the more recent series. Similarly, the incidence of generalized edema was much greater in 1923 and 1924 than it has been recently. It is probable that the nutritional state of the patient plays an important part in the development of both of these complications. Many more diabetic patients with serious undernutrition were being seen in 1923 than today.

In 62 operations for cataract in patients with diabetes the results were as satisfactory as those obtained in cases not complicated with diabetes. This supports the conclusion reached by von Graefe that pessimism in regard to the operative management of this complication is no longer in place. The complete control of glycosuria is not essential for this operation and, indeed, treatment with insulin immediately before or immediately after operation seems to predispose to hemorrhage. Hemorrhage occurred in 8 of the 11 patients who were given insulin immediately before operation and in only 10 of 51 who received no insulin.

DISCUSSION

Dr. Elliott P. Joslin, Boston: The lengthening life of the diabetic child and the recognition of cataracts in diabetic children arouse my apprehension. What a calamity it would be if these young patients, already struggling against odds, ultimately must face blindness! The study of ocular complications in diabetes has been made possible through the support of Mr. and Mrs. Francis P. Garvan and the Chemical Foundation. The chemical part of the work was performed by the late Helen Updegraff, Ph.D., and that work will be reported elsewhere. The clinical aspect of the work has been directed by Dr. Waite, aided by Dr. Beetham. I feel much has been accomplished already, and that the comprehensive beginning thus made will make possible a more systematized attack on the ocular complications in diabetes.

Dr. William P. Beetham, Boston: Similar age groups of diabetic and nondiabetic patients compare favorably with each other in regard to: average systolic blood pressure, average diastolic blood pressure, cardiac enlargement, sclerosis of peripheral vessels and sclerosis of retinal ves-

sels. The outstanding difference between the two groups lies in the fact that retinal hemorrhages were found in 18 per cent of the diabetic group and in only 4 per cent of the nondiabetic group.

DR. ARTHUR J. BEDELL, Albany, N. Y.: Probably all observers agree that with the exception of the peculiar condition called lipaemia retinalis lesions of the eyegrounds do not develop in children even though they may succumb to diabetes. It seems clear, therefore, that the age of the patient, the duration of the disease and the severity of the pancreas involvement, with the resulting damage to the blood vessels, are the essential factors in the production of the lesions in the fundus.

The retina may remain unaffected even when diabetes has been present for years. On the other hand, a hemorrhagic extravasation may be the earliest lesion found in the fundus.

When diabetes is combined with other diseases complicated fundus patterns result. This interesting phase is illustrated in a 64 year old woman with a systolic blood pressure of 180 and sugar (++++) and albumin (++++) in the urine. There were hemorrhages between the vitreous and the retina and in the superficial layers of the retina, and in the deepest portions soft whitish-yellow exudates were evident about the macula.

Many observers have described the development and progress of retinitis in a patient in whom diabetes was considered to be under control. At times it is impossible for the ophthalmologist to impress on the internist the necessity for more vigorous treatment.

A few patients with diabetes complain of sudden loss of sight which is caused by retrobulbar neuritis. There is, however, one type of rapid deterioration of vision which seems to have escaped universal recognition. I refer to a hole in the macula.

There seems to be no way in which the alterations in a deposit of exudate can be so well visualized as by stereoscopic photographs of the fundus. The absorption in one portion and the deposition in another are strikingly evident when one examines a large series of cases.

Book Reviews

Ophthalmological Service of Professor I. Barraquer (in the Santa Cruz and San Pablo Hospital, Barcelona). By Dr. Julio Moreno, Associate professor of Ophthalmology of the Faculty of Medicine, Granada, with a foreword by Prof. M. Márquez, Chief of the Department of Ophthalmology of the Central University, Madrid. Pp. 503, with 297 photographs, 93 reproductions, 68 diagrams and 111 drawings in color. Barcelona: I. G. Seix y Barral Hermanos, 1933.

This is a beautiful volume. It contains a résumé of the more important cases seen in the clinic during 1930, 1931 and 1932, together with descriptions of the operations and other procedures of Professor Barraquer which have seemed of value to the author and his collaborators.

The first part also contains a historical account and description, with pictures, of the extensive Hospital of Santa Cruz and San Pablo, which is a group of pavilions (connected by underground passageways) housing the various specialties and having a bed capacity of 1,100. Then follows a detailed description of the department of ophthalmology, in which the circular operating room with its mercury-lamp indirect lighting system, having no windows and ventilated by a special electric suction apparatus, is most unique.

Barraquer's operation (myocampsis) for strabismus deserves description. Under cocaine and procaine hydrochloride anesthesia the muscle, covered by conjunctiva, is grasped with a Landolt fixation forceps 3 mm. from the point of insertion. After the muscle has been raised from the sclera, the hook of a special instrument (myocampter) is passed through the conjunctiva below and behind the muscle, the tip making its exit at the upper border. By the turning of a screw in the handle the muscle, held on the hook, is drawn upward through a fine silver ring for the desired length of the tuck, and with the instrument at right angles to the muscle the ring is clamped tightly around the fold of the latter with its conjunctival covering, thus fixing the shortening. The patient is not hospitalized; the eyes are not covered, and exercises of reeducation may be commenced almost immediately after the intervention. The metal suture is removed by cutting with scissors when necrosis of the folded part has taken place, which usually occurs within from three to four weeks. (The reviewer was fortunate in seeing Barraquer do one of these operations; the procedure is simplicity itself.) When, however, the deviation is greater than 15 degrees, the additional procedure employed is the rather inexact one of tenotomizing the antagonistic muscle.

A large part of the book is devoted to cases of cataract, and here one finds a detailed description of the operation in which Barraquer's suction apparatus (*Erisiphake*) is used. The various methods of extraction are contrasted, with the conclusion that his method (in his own hands) gives the best results: shortened stay in the hospital,

round pupil, no secondary conditions and better vision. The military precision with which a session of operations for cataract is carried on permits him to do twelve within two hours. There are three patients in the room at one time. One assistant does the injecting for anesthesia, Barraquer does the operating, and another assistant puts on the dressings. Ten minutes is allowed for each step, the end of the interval being announced by the ringing of a bell. The room is fitted with an ophthalmochiroscope through the barrel of which a number of onlookers can get a periscopic close-up of the intervention on the globe.

Although the book is not intended to approach even remotely the status of a treatise on ophthalmology, it contains much valuable information for the ophthalmologist.

The proceeds of the sale of the volume, the price of which is not stated, are donated to the department of ophthalmology of the hospital.

SOLON L. RHODE.

Collected Reprints from the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital. Volume III, January 1932 to June 1933, inclusive. Baltimore, 1933.

The sixty-five articles which have been published by members of the staff of the Wilmer Ophthalmological Institute in various medical journals during the period mentioned have been brought together in this third volume of collected reprints. Eleven publications were not reprinted. A perusal of the subjects of these articles shows the diversity of the work which is being done in this excellent institution. Practically all phases of ophthalmic research are touched on, and many important advances are described.

A. K.

Directory of Ophthalmologic Societies *

INTERNATIONAL

INTERNATIONAL ASSOCIATION FOR PREVENTION OF BLINDNESS
President: Prof. F. de Lapersonne, 217 Faubourg St., Honoré, Paris.
Secretary-General pro tem: Dr. A. Churchill, 66 Boulevard St. Michel, Paris.

INTERNATIONAL OPHTHALMOLOGIC CONGRESS
Secretary: Dr. Francisco Poyales, Olozaga 3, Madrid.

FOREIGN

BRITISH MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY
President: Dr. Frank H. Crawley, 5 Fitzwilliam Pl., Dublin.
Place: Bournemouth, England. Time: July 25-27, 1934.

OPHTHALMOLOGY SOCIETY OF BOMBAY
President: Dr. D. D. Sathaye, 127 Girgaum Road, Bombay 4.
Secretary: Dr. H. D. Dastur, Dadar, Bombay 14.
Place: H. B. A. Free Ophthalmic Hospital, Parel, Bombay 12. Time: First Friday of every month.

OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM
President: Mr. A. H. H. Sinclair, 6 Charlotte Square, Edinburgh.
Secretary: Mr. Humphrey Neame, 56 Portland Place, London, W. I.

OXFORD OPHTHALMOLOGICAL CONGRESS
Master: Dr. Cyril Walker, Bristol, England.
Secretary: Dr. C. G. Russ Wood, Hill House, Abberbury Rd., Iffley, Oxford, England.

ROYAL SOCIETY OF MEDICINE, SECTION OF OPHTHALMOLOGY
President: Dr. A. C. Hudson, 50, Queen Anne St., W. 1, London.
Secretary: Dr. J. D. Magor Carbell, 27, Weymouth St., W. 1, London.

SOCIÉTÉ FRANÇAISE D'OPHTHALMOLOGIE
Secretary: Dr. René Onfray, 6 avenue de la Motte Picquet, Paris 7è.

SOCIETY OF SWEDISH OPHTHALMOLOGISTS
President: Prof. F. Berg, Uppsala, Sweden.
Secretary: Dr. K. O. Granström, Stockholm, Sweden.

GERMAN OPHTHALMOLOGICAL SOCIETY
Secretary: Prof. A. Wagenmann, Heidelberg.
Place: Heidelberg. Time: Aug. 6-8, 1934.

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SECTION ON OPHTHALMOLOGY
Chairman: Dr. Arthur J. Bedell, 344 State St., Albany, N. Y.
Secretary: Dr. Parker Heath, 1553 Woodward Ave., Detroit.
Place: Atlantic City, N. J. Time: 1935.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. J. M. Wheeler, 635 W. 165th St., New York.
President-Elect: Dr. Wells P. Eagleton, 15 Lombardy St., Newark, N. J.
Executive Secretary-Treasurer: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: Chicago. Time: Sept. 9-14, 1934.

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

American Ophthalmological Society

President: Dr. W. G. M. Byers, 1458 Mountain St., Montreal.
Secretary-Treasurer: Dr. J. Milton Griscom, 2213 Walnut St., Philadelphia.

National Society for the Prevention of Blindness

President: Mr. William Fellows Morgan.
Managing Director: Mr. Lewis H. Carris, 50 W. 50th St., New York.
Place: New York. Time: November, 1934.

SECTIONAL

New England Ophthalmological Society

President: Dr. Hugo B. C. Riemer, 128 Newbury St., Boston.
Secretary-Treasurer: Dr. Benjamin Sachs, 483 Beacon St., Boston.
Place: Massachusetts Eye and Ear Infirmary, 243 Charles St., Boston. Time: 8 p. m., third Tuesday of each month from November to April, inclusive.

Pacific Coast Oto-Ophthalmological Society

President: Dr. A. W. Morse, 66 W. Park St., Butte, Mont.
Secretary-Treasurer: Dr. Frederick C. Cordes, 384 Post St., San Francisco.
Place: Butte, Mont. Time: July 16-18, 1934.

Puget Sound Academy of Ophthalmology and Oto-Laryngology

President: Dr. Francis A. Brugman, 509 Olive St., Seattle.
Secretary-Treasurer: Dr. Noble Dick, 1115 Terry Ave., Seattle.
Time: 8 p. m., third Tuesday of each month, except July and August.

Rock River Valley Eye, Ear, Nose and Throat Society

President: Dr. Harry Shearer, 405 E. Grand Ave., Beloit, Wis.
Secretary-Treasurer: Dr. W. S. Beyer, 1101 Talcott Bldg., Rockford, Ill.
Place: Rockford, Ill., Janesville or Beloit, Wis. Time: Third Tuesday of each month.

Saginaw Valley Academy of Ophthalmology and Otolaryngology

President: Dr. A. R. McKinney, 703 Second National Bank Bldg., Saginaw, Mich.
Secretary-Treasurer: Dr. W. K. Slack, 308 Eddy Bldg., Saginaw, Mich.
Place: Saginaw, Mich., or Bay City, Mich. Time: First Friday of each month, except July and August.

Sioux Valley Eye and Ear Academy

President: Dr. John B. Gregg, 101 S. Main St., Sioux Falls, S. Dakota.
Secretary-Treasurer: Dr. F. H. Roost, 420 Trimble Bldg., Sioux City, Iowa.

Southern Medical Association, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Dunbar Roy, 113 N. Pryor St., Atlanta, Ga.
Secretary: Dr. William A. Wagner, 914 American Bank Bldg., New Orleans.
Place: New Orleans. Time: 1934.

Southwestern Michigan Triological Society

President: Dr. Carl Snapp, 604 Medical Arts Bldg., Grand Rapids.
Secretary-Treasurer: Dr. Lee O. Grant, 420 Medical Arts Bldg., Grand Rapids.
Time: Third Thursday of alternate months.

Western Pennsylvania Eye, Ear, Nose and Throat Society

President: Dr. O. G. A. Barker, 532 Main St., Johnstown.
Secretary-Treasurer: Dr. C. W. Beals, Weber Bldg., DuBois.
Time: Third Thursday of October and May.

STATE

Colorado Ophthalmological Society

President: A presiding officer is selected for each meeting alternately until all members have served.
Secretary: Dr. Edna M. Reynolds, 920 Republic Bldg., Denver.
Place: Capitol Life Building, Denver. Time: 7:30 p. m., third Saturday of the month, October to April, inclusive.

Connecticut State Medical Society, Section on Eye, Ear, Nose and Throat

President: Dr. Edward J. Whalen, 750 Main St., Hartford.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.
Time: May, November.

Eye, Ear, Nose and Throat Club of Georgia

President: Dr. W. R. Bedingfield, 753 Broad St., Augusta.
Secretary-Treasurer: Dr. J. A. Smith, 700 Spring St., Macon.

Indiana Academy of Ophthalmology and Oto-Laryngology

President: Dr. J. Kent Leasure, 23 E. Ohio St., Indianapolis.
Secretary: Dr. Fred Overman, 611 Hume-Mansure Bldg., Indianapolis.
Place: Richmond. Time: Dec. 12, 1934.

Iowa Academy of Ophthalmology and Oto-Laryngology

President: Dr. W. F. Boiler, 105 E. Iowa Ave., Iowa City.
Secretary-Treasurer: Dr. Lawrence A. Taylor, 118 E. Second St., Ottumwa.

Michigan State Medical Society, Section of Ophthalmology and Otolaryngology

Chairman: Dr. Peter T. Grant, 148 Monroe Ave., Grand Rapids.
Secretary: Dr. Ralph B. Fast, 1410 Bank of Kalamazoo Bldg., Kalamazoo.
Place: Battle Creek. Time: 1934.

Minnesota Academy of Ophthalmology and Oto-Laryngology

President: Gordon B. New, Mayo Clinic, Rochester.
Secretary-Treasurer: Dr. Walter E. Camp, Medical Arts Bldg., Minneapolis.
Time: Second Friday of each month from October to May.

Montana Academy of Oto-Ophthalmology

President: Dr. Lawrence G. Dunlap, 101 Main St., Anaconda.
Secretary: Dr. A. W. Morse, Phoenix Bldg., Butte.

New Jersey State Medical Society, Section on Ophthalmology, Otology and Rhinolaryngology

Chairman: Dr. S. T. Hubbard, 294 State St., Hackensack.
Secretary: Dr. G. S. Laird, 125 Central Ave., Westfield.

New York State Medical Society, Eye, Ear, Nose and Throat Section

Chairman: Dr. Frank M. Sulzman, 1831 Fifth Ave., Troy.
Secretary: Dr. Webb W. Weeks, 20 E. 53rd St., New York.

North Dakota Academy of Ophthalmology and Oto-Laryngology

President: Dr. H. O. Ruud, 318 De Mers Ave., Grand Forks.
Secretary-Treasurer: Dr. F. L. Wicks, 516 Fourth St., Valley City.
Place: Valley City. Time: 1934.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY
President: Dr. A. B. Dykman, Medical Dental Bldg., Portland.
Secretary-Treasurer: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY
President: Dr. Robert C. O'Neil, 105 Waterman St., Providence.
Secretary and Treasurer: Dr. Gordon J. McCurdy, 122 Waterman St., Providence.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

SOUTH CAROLINA SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. Walter Bristow, Medical Bldg., Columbia.
Secretary: Dr. J. W. Jervey, Jr., 101 Church St., Greenville.

TENNESSEE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY
President: Dr. C. D. Blassingame, 899 Madison Ave., Memphis.
Secretary-Treasurer: Dr. Ralph O. Rychener, 130 Madison Ave., Memphis.

TEXAS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY
President: Dr. C. C. Cody, 1304 Walker Ave., Houston.
Secretary: Dr. O. M. Marchman, 1719 Pacific Ave., Dallas.

UTAH OPHTHALMOLOGICAL SOCIETY
President: Dr. F. R. Slopanskey, 9 Exchange Pl., Salt Lake City.
Secretary-Treasurer: Dr. T. F. Welsh, 920 Boston Bldg., Salt Lake City.
Time: Third Monday of each month.

VIRGINIA SOCIETY OF OTO-LARYNGOLOGY AND OPHTHALMOLOGY
President: Dr. H. G. Preston, 307 Professional Bldg., Harrisonburg.
Secretary: Dr. Edwin W. Burton, 104 E. Market St., Charlottesville.

WEST VIRGINIA STATE MEDICAL ASSOCIATION, EYE, EAR, NOSE AND THROAT SECTION
President: Dr. Harry V. Thomas, 95 Fairmont Ave., Fairmont.
Secretary: Dr. W. F. Beckner, 1050 Fifth Ave., Huntington.

LOCAL

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON EYE, EAR, NOSE AND THROAT
Chairman: Dr. Browne Morgan, 260 Liberty St., Bloomfield.
Secretary: Dr. A. Russell Sherman, 671 Broad St., Newark.
Place: 91 Lincoln Park South, Newark. Time: 8:45 p. m., second Monday of each month.

ACADEMY OF MEDICINE OF TORONTO, SECTION OF OPHTHALMOLOGY
Chairman: Dr. Colin Campbell, 170 St. George St., Toronto.
Secretary: Dr. H. M. Macrae, 170 St. George St., Toronto.
Time: First Monday of winter months.

ATLANTA EYE, EAR, NOSE AND THROAT SOCIETY
President: Dr. W. L. McDougall, 50 Whitehall St., Atlanta, Ga.
Secretary: Dr. William O. Martin, Jr., 384 Peachtree St., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: 8 p. m., last Thursday of each month.

BALTIMORE MEDICAL SOCIETY, SECTION ON OPHTHALMOLOGY
Chairman: Dr. Benjamin Rones, Johns Hopkins Hospital, Baltimore.
Secretary: Dr. William M. Rowland, 906 Cathedral St., Baltimore.
Place: Medical and Chirurgical Faculty, 1211 Cathedral St. Time: 8:30 p. m., fourth Thursday of each month from October to May.

Brooklyn Ophthalmological Society

President: Dr. John H. Bailey, 855 St. Marks Ave., Brooklyn.
Secretary-Treasurer: Dr. George Freiman, 703 Grand St., Brooklyn.
Place: Kings County Medical Society Bldg., 1313 Bedford Ave. Time: Third Thursday in February, April, May, October and December.

Buffalo Ophthalmologic Club

President: Dr. H. H. Glosser, 448 Franklin St., Buffalo.
Secretary-Treasurer: Dr. I. J. Koenig, 40 North St., Buffalo.

Chicago Ophthalmological Society

President: Dr. Dwight C. Orcutt, 30 N. Michigan Ave., Chicago.
Secretary: Dr. Richard C. Gamble, 30 N. Michigan Ave., Chicago.
Place: Medinah Michigan Avenue Club, 505 N. Michigan Ave. Time: Third Monday of each month from October to May.

Cleveland Academy of Medicine, Section of Ophthalmology and Otolaryngology

Chairman: Dr. A. L. Stotter, 1148 Euclid Ave., Cleveland.
Secretary: Dr. James T. Collins, 1105 Medical Arts Bldg., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

Cleveland Ophthalmological Club

Chairman: Dr. W. P. Chamberlain, 7405 Detroit Ave., Cleveland.
Secretary: Dr. A. D. Ruedemann, Cleveland Clinic, Cleveland.

College of Physicians, Philadelphia, Section on Ophthalmology

Chairman: Dr. John Milton Griscom, 2213 Walnut St., Philadelphia.
Clerk: Dr. Alexander G. Fewell, 1924 Pine St., Philadelphia.
Time: Third Thursday of every month from October to April, inclusive.

Columbus Ophthalmological and Oto-Laryngological Society

Chairman: Dr. Albert D. Frost, 681 E. Broad St., Columbus, Ohio.
Secretary-Treasurer: Dr. M. Goldberg, 328 E. State St., Columbus, Ohio.
Time: First Monday of each month.

Dallas Academy of Ophthalmology and Oto-Laryngology

President: Dr. T. S. Love, 1719 Pacific Ave., Dallas, Texas.
Secretary: Dr. Daniel Brannin, 1719 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6:30 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Des Moines Academy of Ophthalmology and Otolaryngology

President: Dr. C. C. Walker, 410 6th Ave., Des Moines, Iowa.
Secretary-Treasurer: Dr. Grace Doane, 614 Bankers Trust Bldg., Des Moines, Iowa.
Time: 7:45 p. m., third Monday of every month, September to May.

Detroit Ophthalmological Club

Chairman: Members rotate alphabetically.
Secretary: Dr. Raymond S. Goux, David Whitney Bldg., Detroit.
Time: 6:30 p. m., first Wednesday of each month.

Eastern New York Eye, Ear, Nose and Throat Association

President: Dr. Edward B. O'Keefe, 901 State St., Schenectady.
Secretary-Treasurer: Dr. W. C. Mott, 118 Washington Ave., Albany.
Time: Third Wednesday in October, November, March, April, May and June.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. E. L. Howard, 600 W. 10th St., Fort Worth, Texas.
Secretary-Treasurer: Dr. Van D. Rathgeber, 1012 Medical Arts Bldg., Fort Worth.
Place: Medical Hall, Medical Arts Bldg. Time: 7:30 p. m., first Friday of each month except July and August.

Grand Rapids Eye, Ear, Nose and Throat Society

President: Dr. Carl F. Snapp, 26 Sheldon Ave., Grand Rapids, Mich.
Secretary-Treasurer: Dr. Walter W. Oliver, 320 Medical Arts Bldg., Grand Rapids, Mich.
Place: Various local hospitals. Time: Third Thursday of alternating months, September to May.

Houston Academy of Medicine, Eye, Ear, Nose and Throat Section

President: Dr. E. L. Goar, 1304 Walker Ave., Houston, Texas.
Secretary: Dr. J. C. Dickson, 622 Medical Arts Bldg., Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., second Thursday of each month from September to June.

Indianapolis Ophthalmological and Otolaryngological Society

President: Dr. D. A. Bartley, 23 E. Ohio St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, 23 E. Ohio St., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

Kansas City Society of Ophthalmology and Oto-Laryngology

President: Dr. M. B. Simpson, 1103 Grand Ave., Kansas City, Mo.
Secretary: Dr. Harold B. Hedrick, 618 Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

Chairman: Dr. Russell T. Uhls, 110 Pine Ave., Long Beach, Calif.
Secretary-Treasurer: Dr. Kenneth C. Brandenburg, 707 Security Bldg., Long Beach, Calif.
Place: Professional Bldg. Time: Last Wednesday of each month from October to May.

Los Angeles Society of Ophthalmology and Oto-Laryngology

President: Dr. F. H. Brandt, 1136 W. Sixth St., Los Angeles.
Secretary-Treasurer: Dr. Pierre Viole, 1930 Wilshire Blvd., Los Angeles.
Place: Los Angeles County Medical Association Bldg., 1925 Wilshire Blvd. Time: 6:30 p. m., fourth Monday of each month from September to May, inclusive.

Louisville Eye, Ear, Nose and Throat Society

President: Dr. Charles Dwight Townes, 332 W. Broadway, Louisville, Ky.
Secretary-Treasurer: Dr. J. S. Bumgardner, 1103 Heyburn Bldg., Louisville, Ky.
Place: French Village. Time: Second Thursday of each month, September to May, inclusive, at 6:30 p. m.

Medical Society of the District of Columbia, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. George B. Trible, 1801 I St., Washington.
Secretary: Dr. Harry F. Davies, 1835 I St., Washington.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month from October to April, inclusive.

Memphis Society of Ophthalmology and Otolaryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

Milwaukee Oto-Ophthalmic Society

Secretary-Treasurer: Dr. Herbert G. Schmidt, 238 W. Wisconsin Ave., Milwaukee.
President: Dr. O. P. Schoofs, 324 E. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., fourth Tuesday of each month.

Montreal Ophthalmological Society

President: Dr. J. A. MacMillan, 1410 Stanley St., Montreal, Canada.
Secretary: Dr. A. L. Guertin, 410 Sherbrooke St., West, Montreal, Canada.
Time: Second Thursday of October, December, February and April.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. Frederick E. Hasty, 119, 7th Ave. N., Nashville, Tenn.
Secretary-Treasurer: Dr. Kate Savage Zerfoss, 803 Medical Arts Bldg., Nashville, Tenn.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month from October to June.

New Orleans Ophthalmological and Otolaryngological Society

President: Dr. M. F. Meyer, Canal Bank Bldg., New Orleans.
Secretary-Treasurer: Dr. R. H. Fisher, Chess and Checker Club, New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: Third Thursday of each month from October to June.

New York Academy of Medicine, Section of Ophthalmology

Chairman: Dr. Webb William Weeks, 20 E. 53rd St., New York.
Secretary: Dr. Guernsey Frey, 121 E. 60th St., New York.
Time: 8:30 p. m., third Monday of every month from October to May, inclusive.

Omaha and Council Bluffs Ophthalmological and Oto-Laryngological Society

President: Dr. Abbott M. Dean, 532, 1st Ave., Council Bluffs, Iowa.
Secretary-Treasurer: Dr. Robert H. Rasgorshek, 425 Aquila Court, Omaha.
Place: Omaha Club, 20th and Douglas Sts., Omaha. Time: 6 p. m., dinner; 7 p. m., program; third Wednesday of each month from October to May.

Philadelphia County Medical Society, Eye Section

Chairman: Dr. Charles R. Heed, 1205 Spruce St., Philadelphia.
Secretary: Dr. Sidney L. Olsho, 235 S. 15th St., Philadelphia.
Time: Second Tuesday of each month from October to May.

Pittsburgh Ophthalmological Society

President: Dr. Edward B. Heckel, Jenkins Arcade Bldg., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine Bldg. Time: Fourth Monday of each month, except June, July, August and September.

Pittsburgh Slit-Lamp Society

President: Dr. W. W. Blair, 121 University Pl., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: 121 University Pl. Time: Second Monday evening of every month, except June, July, August and September.

Richmond Ophthalmological and Oto-Laryngological Society

President: Dr. F. H. Lee, 501 E. Franklin St., Richmond, Va.
Secretary: Dr. William R. Weisiger, Medical Arts Bldg., Richmond, Va.
Place: Westmoreland Club. Time: 6 p. m., second Monday of each month from October to May.

Rochester Eye, Ear, Nose and Throat Society

President: Dr. E. W. O'Brien, 5 N. Goodman St., Rochester, N. Y.
Secretary-Treasurer: Dr. W. D. Edwards, 389 Monroe Ave., Rochester, N. Y.
Place: Rochester Medical Association, 113 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ophthalmic Society

President: Dr. E. C. Spitze, 234 Collinsville Ave., East St. Louis, Ill.
Secretary: Dr. Carl T. Eber, 1006 Carleton Bldg., St. Louis.
Place: Oscar Johnson Institute. Time: Clinical meeting 5:30 p. m., dinner and scientific meeting 6:30 p. m., fourth Friday of each month from October to April, inclusive, except December.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. Robert E. Parrish, 712 Medical Arts Bldg., San Antonio, Texas.
Secretary-Treasurer: Dr. Frank Steed, Nix Professional Bldg., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

San Francisco County Medical Society, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Robert S. Irvine, 490 Post St., San Francisco.
Secretary: Dr. Frank H. Rodin, 490 Post St., San Francisco.
Place: Society's Building, 2180 Washington St., San Francisco.
Time: Fourth Tuesday of every month except May, June, July and December.

Shreveport Eye, Ear, Nose and Throat Society

President: Dr. W. L. Atkins, 940 Margaret Pl., Shreveport, La.
Secretary-Treasurer: Dr. Leon F. Gray, 1214 Slattery Bldg., Shreveport, La.
Place: 1240 Texas Ave. Time: 8:15 p. m., fourth Tuesday of every month except June, July and December.

Spokane Academy of Ophthalmology and Oto-Laryngology

President: Dr. Marc Anthony, 422 Riverside Ave., Spokane, Wash.
Secretary: Dr. Raymond A. Lower, 1455 Paulsen Medical and Dental Bldg., Spokane, Wash.
Place: Paulsen Medical and Dental Library. Time: 8 p. m., fourth Tuesday of each month except June, July and August.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. H. O. Brust, 820 S. Crouse Ave., Syracuse, N. Y.
Secretary-Treasurer: Dr. W. J. Werfelmann, 109 S. Warren St., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.

Tulsa Academy of Ophthalmology and Otolaryngology

President: Dr. Roy Dunlap, Medical Arts Bldg., Tulsa, Okla.
Secretary-Treasurer: Dr. Marvin D. Henley, Medical Arts Bldg., Tulsa, Okla.
Place: Medical Arts Bldg. Time: Monthly.